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INVESTIGATION OF FUNDS FLOW ANALYSIS APPROACH TO DETERMINING RAILWAYS' FAIR RATE OF RETURN

BY

Ⓒ RAY C. BASSETT

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
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(Supervisor)

G P Reschenthaler

Date: April 23, 1985

TO MY WIFE KELLY

ABSTRACT

There are three critical aspects of Canadian railway legislation which require an accurate measure of the cost of capital. The most important of these are the various programs to subsidize the railways for the costs of imposed public duties. Other components of railway regulation control minimum and maximum rates which the railways can charge and set criteria for the abandonment or discontinuance of various services. As part of their responsibility for administering these regulations, the Canadian Transport Commission makes an annual determination of the railways' cost of capital.

The current procedure used by the Commission is based on the rate base-rate of return formula which is commonly used in public utility regulation. However, this procedure has, over the years, yielded results which are far in excess of reported railway earnings. This paper explores the reasons for this discrepancy and determines that it is primarily due to the use of the net book value as an estimator of the market value of railroad assets when utilizing the rate base-rate of return formula. Through an analysis of available information it was demonstrated that the market value of railway assets is very likely below net book value.

The funds flow model is a procedure which has been used by American railroad regulators for measuring the minimum return expected by

investors in situations where the asset base is not known and thought to be below net book value. Underlying the model is the premise that the minimum cash flow expected by investors is one which will maintain the financial capital invested in the railway. Through the construction of pro forma sources and uses of funds statements the model estimates the minimum required earnings expected by investors. By computing the earnings directly as a cash cost rather than a rate of return, the model is not dependent on the measurement of the asset base.

The purpose of this paper is to evaluate the funds flow model to determine its validity on a theoretical basis and to assess its applicability to Canadian railway regulation. To accomplish this the model was examined from a theoretical and practical perspective. On the theoretical side, the model was found to be consistent on a conceptual basis with both the theory of finance and regulation. However, the absence of comprehensive empirical tests of the funds flow model's ability to explain the structure of the capital markets, made it impossible to comment on the validity of the model.

The other tests applied to the model concentrated on the validity of its assumptions, its administrative problems, and its ability to contribute to the resolution of current issues related to the measurement of the cost of capital and rate of return. In this regard the greatest strength of the model is that it is able to contribute information to the resolution of the asset base valuation problem. In

general, the assumptions used to contract the model are reasonable and the implementation problems should be minimal for a regulator with access to the necessary information.

The paper concludes that the funds flow model appears to be conceptually sound and potentially useful to the regulators of Canada's railroads. It is not proposed that the funds flow model replace the rate base rate of return formula but that it be used to supplement it.

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CHAPTER I

INTRODUCTION

Since the first railways in Canada were built, they have been viewed as an industry vested with the public interest. In Canada, as in most other countries, the railways are considered essential for the economic and social development of the nation. However, unlike almost every industrialized country,[1] Canada has chosen to have its railway system operated by autonomous entities[2] subject to regulatory constraints.

Given the changes in the economic and political environment, it is not surprising that the railways have, over the years, experienced varying degrees of regulatory control over their operating, investment, and pricing decisions. In addition, the government, from time to time, has deemed particular uneconomic services as essential to the public interest and ordered them continued at taxpayers' expense.

The government's desire to both have viable railway enterprises and to control the economic activities of these enterprises can result in a situation where it must reconcile conflicting goals. On one side government policy must ensure that the railways are able to generate sufficient revenues to maintain the existing rail system and to attract new capital to expand. However, this goal must be counter balanced against the desire to provide railway service at the lowest cost to railway users and taxpayers. Resolution of these conflicting goals is a complex problem which has, and continues to be, one of the most controversial issues in the regulation of the Canadian railway industry. One of the fundamental issues in resolving this dilemma is the determination of a "fair rate of return" on the capital employed in the railway enterprise.

While the controversy surrounding the determination of a fair rate of return has not diminished over time it has changed its focus considerably. Prior to the passage of the 1967 National Transportation Act (NTA)[156] the rate of return issue had been central in the Board of Transport Commissioners' review of general freight rate increases. With the major shift in policy which occurred in 1967, the focus turned toward measurement of the rate of return appropriate for providing specific services. The NTA represented a major step toward deregulation of the railways. Rather than controlling all railway rate increases, the policy called for regulatory intervention only under certain specific conditions[3]. Other major changes included the establishment of procedures to review uneconomic services and to directly compensate the railways for those services provided as imposed public duties. Under the Act specific subsidies were established for light density branch lines and rail passenger services. These subsidies were in addition to the Maritime Freight Rates and the 'At and East' subsidies which had already been in existence for a number of years. Since the Act was passed a cost based rate structure for rapeseed products has been established and a decision to subsidize grain transportation has been made. Implementation of all of these specific legislative and regulatory provisions require that the regulator compensate the investor for the use of the assets employed in a particular service deemed to be necessary in the public interest.

In both past and existing regulatory environments the process of determining the fair rate of return has been very contentious. The reason is simple, the dollar impact on various interested parties is very significant. In terms of the current cost and investment levels, a one per cent change alters the overall required rate of return for Canadian railways by about 50 to 60 million dollars. With the railways receiving approximately 20 to 25 per cent of their gross revenues from such government subsidized services as VIA Rail Canada, grain transportation, and branch lines, the railways, not surprisingly, have directed considerable resources towards this issue.

Issues surrounding the determination of the fair rate of return range from the deceptively simple to the very complex. It is the inability to resolve some of the obvious questions which has cast suspicion on the entire process of rate of return determination. It is one of these deceptively simple questions which gave rise to this paper. Observers of Canadian railways have noticed some apparent inconsistencies in recent years. The first point is the claim by the railways that a fair rate of return is in the neighbourhood of 16-18 per cent. The railway claim that this level of return is necessary if they are to remain viable. However, reported earned rates of return on net investment have historically been substantially less than this level ranging from 4 to 8 per cent[4]. Despite these apparently low rate of return the railways have continued to raise debt capital and invest in the rail plant. It is the thesis of the paper that current procedures for estimating the fair rate of return are not, in themselves, sufficient to resolve this apparent inconsistency. Furthermore, it is contended that, through the use of an alternative procedure for estimating the fair rate of return the cause of this inconsistency can be neutralized. This alternative approach, called the Funds Flow Analysis, has been used in the United States and appears to have sufficient merit to warrant a study such as this into its applicability to the Canadian railroad regulatory environment.

1. BACKGROUND

The determination of a "fair rate of return" requires a balancing of the social and economic goals of regulation with the return expected by investors as measured by the cost of capital. The terms rate of return and cost of capital are often used somewhat interchangeably. While they are similar concepts, there is a major difference. The cost of capital is a measure of the opportunity cost of the capital employed and is based on financial theory. Rate of return, on the other hand, is a regulatory concept which reflects the level of earnings on assets employed that should be allowed by the regulator. The important distinction is that the rate of return may or may not equal the cost of capital. There are two fundamental reasons for this. The first is the regulators must make decisions based on more than just economic efficiency. Political, social, and behavioral considerations are often accorded some weight when the fair rate of return is set. The second and more critical reason is that the cost of capital cannot be precisely measured. Significant advances have been made in the development of various techniques for the measurement of the cost of capital to the firm and paralleling these theoretical developments have been major changes in the procedures used by regulatory bodies. Yet despite this progress, there is not yet consensus on how to best measure the cost of capital. As a result, the determination of a "fair rate of return" still requires subjective judgment. This situation is evident from decisions made by regulatory bodies. Decisions will often summarize the information and data considered and then state, without explanation, the rate of return to be used. For example, the Railway Transport Committee's (RTC) decisions on cost of capital only provide the Committee's findings and do not provide the supporting rationale used by the regulator in making the annual determination.

The roots of contemporary issues surrounding the fair rate of return debate lie in the adoption of the rate base rate of return methodology[5] for determining the rate of return back in 1967. The problem is not so much with the rate base of return approach per se but some structural aspects of Canadian railroads which cause this approach to yield suspicious results. For the rate base-rate of return to function there must be both a measure of the rate of return (in percentage terms) and of the value of assets employed. Since both the Canadian Pacific Railway (CP Rail) and the Canadian National Railway (CN Rail) are not separate corporate entities but divisions of a larger parent organization, the calculation of both the rate of return and the asset values are greatly complicated. As there is no market for railway securities, the cost of capital must be indirectly determined. In addition neither company has a separate balance sheet for railway operations. Consequently, the quantity and value of assets assigned to the railway have an arbitrary component. Further complicating this problem is the fact that only recently has CN Rail maintained separate property accounts for rail assets. With these problems, in addition to the problems normally encountered in rate of return proceedings, it is not surprising that a great deal of controversy surrounds this topic.

During the 1970's the controversy grew as the government had to deal with rapidly increasing losses on passenger, branch line and grain services. In 1977, the Governor-in-Council ordered the CTC to initiate a review of its costing procedures, including its procedures for calculating the cost of capital. Due to their complexity, the cost of capital issues were separated from the other issues and made the subject of a separate study.

Participants in the cost of capital review[6] have suggested both modifications to the existing rate base-rate of return methodology and other options to the rate base-rate of return formula. In the initial stages of the review, two alternatives were developed in detail and proposed. They were both based on the argument that the presently used historic valuation of the asset base incorrectly represented the fair value of the assets employed. Arguing the assets were undervalued, the railways proposed that the Commission adopt a procedure based on the current value of the assets employed in the railway enterprise. From the opposite perspective, the provinces argued that the asset base was over stated. They proposed the use of a funds flow analysis which directly calculates the cost of capital as a cash cost(cash flow) as opposed to a percentage return on assets. As the scope of the cost of capital review narrowed, both the current value and funds flow approaches were taken off the agenda.[7] In removing there alternative proposals from the agenda no judgment was made on their relative merits. In fact, the basis for their being omitted from the agenda was that they should each be considered in a more appropriate forum.

The cash flow requirement is a attractive concept in that it is not dependent on the asset base valuation. This methodology, if valid, could eliminate some of the previously cited problems caused by the structural aspects of Canadian railways. Proponents of this methodology also argue that it would help explain the discrepancy between the railways' claimed required rate of return with the return actually earned.

The funds flow methodology is not new. It was first proposed in 1969 when the Railway Transport Committee (RTC) was conducting hearings on costing procedures required to implement the National Transportation Act. The Committee did not adopt the procedure and opted to continue to use the rate base-rate of return method. During the mid 1970's, the Interstate Commerce Commission (ICC) in the United States conducted extensive studies and hearings into the adequacy of railway earnings. The basis for the ICC's conclusion in this regard was an analysis of the cash flow requirements of the United States railroads. An analysis using the rate base rate of return methodology was also undertaken but was found to yield unrealistic results. During these Ex Parte proceedings the functional purpose of the funds flow model was described as follows[72,pp26]:

> It was a desire to find a direct means for measuring direct revenue need that prompted the development of the funds flow model in Ex Parte No. 271. The procedure embodied in this model is to project the needed capital outlays and other fund requirements of the railroads, to determine the amount of funds available to them from operations and capital sources, and to ascertain the projected requirements. The dollar amount of this shortfall is revenue needed. For ease of application, this needed revenue amount can be translated into a percentage return on net investment.

The use of the funds flow procedure was halted in 1981 after the passage of the Staggers Rail Act in 1980 significantly altered the regulatory environment for U.S. railroads. However, the experience in the United States with the funds flow methodology demonstrated on a prima facie basis that the funds flow methodology has some characteristics which make it potentially useful in the rate of return determination for Canadian railroads. The objective of this paper is to evaluate the funds flow methodology in greater depth to determine its validity on a theoretical basis and to assess its applicability to Canadian railroad regulation.

2. METHODOLOGY

From the foregoing discussion it is apparent that evaluation of the model cannot be done on just a quantified basis. Such an approach would require prior knowledge of the actual cost of capital to use as a basis for comparison. The actual cost of capital is not known. Therefore, the following combination of conceptual and analytical criteria were developed as a basis for evaluating the funds flow model:

a. The model must be consistent with existing financial theory on cost of capital determination.

b. The model must be consistent with existing regulatory theory on rate of return.

c. The model must contribute to the resolution of current issues related to the measurement of the cost of capital and rate of return.

d. The model must be based on valid assumptions.

e. The model must yield quantitative results which are consistent with the premises on which the model was built.

f. The model must be practical to implement.

The approach used in this study is to investigate the funds flow model relative to each of the six criteria described above.

Chapters Two and Three examine in some detail the cost of capital concept as it is viewed in contemporary financial theory and contrast this with the rate of return concept as it is viewed from a regulatory theory perspective. Taken together, these two chapters provide the basis for determining the theoretical validity of the funds flow model and determining whether this model, if theoretically valid, contributes significant new information to regulators charged with the responsibility for setting a fair rate of return.

Chapter Two focuses on the cost of capital. Various models currently used are presented along with their theoretical basis, strengths and weaknesses. Building on Chapter Two, the third chapter examines the regulatory theory behind rate of return determination and presents various methodologies which are used by regulators.

The Fourth chapter describes the regulatory framework for Canadian railways and focuses on those aspects of regulation which require a measure of a fair rate of return. As mentioned earlier, controversy surrounding the existing methodology used by the Railway Transport Committee in calculating the cost of capital, was the main reason for the proposal to use the funds flow model. This chapter describes why the existing procedure was adopted, how it is applied, and the problems associated with its use. It will be demonstrated that the information currently used by the Railway Transport Committee in determining the rate of return for Canadian railways is incomplete and potentially misleading.

A detailed description of the funds flow model is presented in Chapter Five. The theoretical basis for the model are outlined along with the assumptions implicit in the model. Since the model has only been used in the United States considerable attention is given to the purposes for which it was used there and the methodology they employed.

The funds flow model developed in the United States cannot be directly used in a Canadian regulatory environment. Therefore, the model had to be modified before it could be tested quantitatively. Chapter Six describes the necessary modifications and the results of a limited number of quantitative tests of the model. The extent to which the model could be tested was severely constrained by the availability of data. Much of the data necessary to test funds flow model is not public except for the five year period[8] under review by the CTC. The results of the funds flow calculations are then compared to the results obtained by the Railway Transport Committee using other more commonly used models[9].

Based on the material presented in Chapters Two through Five, the final chapter evaluates the funds flow model relative to the five criteria set out above. From the experience with the funds flow methodology in the U.S. and its brief examination in Canada a number of criticisms have been directed at the model. These criticisms are presented and commented on in this chapter. The latter part of the chapter presents the conclusions of this study and identifies additional research which is required. It is not the intention of this study to resolve the debate over the measurement of the cost of capital or the setting of a fair rate of return. Rather, it is to determine whether a funds flow model can contribute information to the individual charged with the responsibility of determining the cost of capital and setting a fair rate of return. The conclusions of this study reflect this goal.

3. LIMITATIONS

The focus of this paper is on the theoretical validity and the usefulness of the funds flow model. As such this study emphasizes qualitative rather than quantitative analysis. Some quantitative tests of the model are presented. The purpose of their inclusion is to demonstrate how the model works and that it can yield reasonable results. Insufficient data dictated that detailed quantification and testing of the model must be left for future research. The results of this study should determine whether such further research is warranted.

There are many issues associated with the measurement of the cost of capital. Each of these could be made the topic of a separate paper. In most cases the CTC has made a ruling at some point in time on how the issue is to be treated for regulatory purposes. Therefore, in as effort to limit the scope of this study, the CTC treatment has been taken as given. Where the issue has a significant impact on the funds flow model it is identified and, in some instances, quantified.

ENDNOTES

1. The United States is the only notable exception.
2. The Canadian National Railway is a crown corporation with a mandate to operate on a business like basis.
3. The railways were given the freedom to set rates. Rate regulation was restricted to setting minimum and maximum rate levels calculated on a cost basis wherein cost was defined to include depreciation and cost of capital. In addition, a provision was made to permit shippers to appeal rates on public interest grounds.
4. This range is for the period 1977 to1982. A major contributing factor to the low rate of return experienced by the railways was the existence of the Statutory Grain Rates. However, resolution of this issue will only increase reported rates of return by about 4 percentage points for CP Rail and about 5 percentage points for CN Rail. This is not enough to eliminate the discrepancy.
5. Rate base rate of return will be explained in greater detail in Chapter 3 but for now suffice it to say that it is the product of a rate of return (expressed as a per cent) applied to a measure of the value of assets employed by the enterprise.
6. Active participants in the Committee include CN Rail, CP Rail, Class I railways, the Provinces and the Prairie Co-operative Grain Producers.
7. It was an agreement between the participating parties to limit the scope of the hearing by removing from the agenda these very controversial items. Even without these two issues the hearing alone lasted over forty days.
8. The CTC review of the cost of capital is based on the years 1981 to 1983. However, related data was made available back to 1976
9. Other models studied included discounted cash.

CHAPTER II

COST OF CAPITAL: A THEORETICAL BASIS FOR THE "FAIR RATE OF RETURN"

A measure of the cost of capital is the most important input into the determination of the fair rate of return. In fact, the fair rate of return is often set equal to the cost of capital. Thus the relationship between these two concepts can be described as one of set and sub-set where the fair rate of return is the set and the cost of capital is the sub-set. Since the funds flow methodology purports to measure the fair rate of return it must be evaluated relative to both cost of capital and regulatory theory.

The purpose of this chapter is to establish the first part of the theoretical basis necessary to evaluate the funds flow methodology and compare it to other contemporary measures. Chapter III will examine the pertinent aspects of the theory of regulation and draw this together with the material presented in this chapter into a description of the fair rate of return concept.

Various financial instruments can be used by a company to attract funds. Each of these instruments, be they debt instruments, preferred shares, or common equity, all have unique characteristics and costs. The required return on the mixture of financial instruments used by a firm (its capital structure) is usually obtained by estimating the cost of each component and then determining a weighted cost of capital. Therefore, the determination of the cost of capital requires two inputs; the cost of the various financial instruments used and the weight to be attached to each. The subsequent discussion of the cost of capital will first define the cost of capital and then address the cost of the general types of financial instruments starting with the cost equity. Since the cost of equity capital is one of the most researched and least refined areas of financial theory, the majority of the discussion will be concentrated in this area. After examining the cost of equity, the procedures for calculating the cost of debt and preferred shares will be presented.

There are only two general weighting schemes, market and book, which are commonly used and these will be discussed near the end of this section. The final topic to be discussed under the heading of the cost of capital is a special problem which arises when estimating the cost of capital for entities such as the Canadian railroads. These entities are divisions of larger corporations and do not have separately traded securities. Some of the more generally accepted procedures used to handle this situation are presented and discussed.

The summary which completes this chapter reviews the salient points necessary to evaluate the funds flow methodology and to bridge this chapter to the subsequent discussion of fair rate of return. In addition, the summary will comment on the state of the art in so far as cost of capital determination is concerned.

1. COST OF CAPITAL DEFINED

Capital theory is one of the most difficult areas of economic theory. Consequently, it is not surprising that there is not a generally agreed upon definition of the cost of capital. In fact, there is some disagreement, albeit not to the same degree, over the definition of capital itself. For purposes of this paper capital is defined as the funds invested in a firm. The capital supplied may take many forms including bonds, debentures, trust certificates, preferred shares, common shares, and retained earnings. These funds are normally invested in long lived physical assets used to produce the output of the firm. The total monetary value of the physical assets[1] is usually referred to as the stock of capital[27,ppl] Before the cost of capital can be defined it is necessary to determine from which perspective the cost of capital is to be measured. The cost of capital can be viewed as the cost to society, the cost to the supplier of capital, the cost to the firm, or the cost to the user of the product or service produced.[2]

In its most fundamental sense the cost of capital is the return expected by investors on capital invested in a firm. It is usually expressed as a percentage which when multiplied by the value of the investment represents the dollar cost of the funds in a particular time period.

The economist who is concerned with the optimal allocation of scarce resources views the cost of capital as an opportunity (marginal) cost. Myers observes that opportunity cost is a marginal and forward looking concept. Thus, the opportunity cost of investing in a particular asset is usually defined as the anticipated return on an incremental investment in the best alternative use. Stated differently, it is the return necessary to attract capital to the firm. In an efficient market, the cost of capital measured as an opportunity cost would meet two of the criteria necessary for the efficient use of investment funds[111]:

1. the marginal rates of return on a new investment would be equal among risk identical alternatives.
2. the marginal rates of return would equalize with the opportunity cost of the lender's funds.

The financial theorist takes a slightly different approach to defining the cost of capital. By assuming financial markets are in equilibrium they view the cost of capital as a variable that can be observed in the capital markets. Brigham and Gordon[16,pp85] define the cost of capital as "the rate of return the firm must earn on net investment in order to maintain the market price of its existing common stock unchanged".[3]

Conceptually, the financial definition of cost of capital is based on a generally accepted assumption concerning the valuation of a firm's securities. It is assumed that current market price per unit of a firm's securities equals the discounted value of the stream of current and future levels of expected earnings. Expected earnings are defined as either current and future expected cash flows or as the discounted value of current and future dividends. The discount rate in these valuation models is the capital cost rate for the particular security. This discount rate represents investors' collective expectations of future earnings and collective assessment of the risks inherent in these expected future earnings.

Both the economic and financial definitions given above are ex ante measures of the cost of capital and they both embrace the opportunity cost principle. However, when the cost of capital is defined for some regulatory purposes, the working definitions of the cost of capital often stray from these ideals. While no one will dispute the opportunity cost principle, they do dispute its use as a basis for compensation or rate setting where there is debt in the capital structure. The problem is that the opportunity cost is a measure of costs to society but not a measure of the costs actually incurred by the regulated entity. Consider for example the calculation of the cost of capital for purposes of paying a subsidy for a service which was performed. Not surprisingly, the issue of which interest rate, embedded or current market, should be used on long term debt often arises. For reasons which will become evident later, use of the current market rate for debt could create 'windfall' gains or losses to equity investors.

A review of the literature reveals that there is no consistently used definition of the cost of capital when it is used within a regulatory setting. Generally speaking, the definition did not change depending on the end use for which the cost of capital was to be calculated. However, based on a review of the findings of several regulatory bodies[4] one basic theme did emerge. Most definitions offered tended to argue for a particular cost of capital rate in terms of the level of earnings required to meet the investors' expectations. For purposes of this paper, the cost of capital is defined as "the dollar amount of return on debt and equity required by investors". This definition can be viewed as a sub-set of the financial theory definition with the difference arising out of the need to be more precise in the defining of what costs are to be included in the cost of capital under different conditions.

As mentioned above the normal way of expressing the cost of capital is as a percentage rate of return. This convention is based on the premise that, at any point in time, there is an unique expected rate of return prevailing in the capital markets for a particular degree of risk. To calculate the dollar cost of capital at a particular period in time the market rate of return is multiplied by the value of the capital assets held by the investor.[5] The amount so calculated is the expected cash flow to suppliers of capital for a specified time period (usually one year). In other words, the cash flow must be sufficient to pay the interest on fixed rate debt instruments, to pay the dividends expected by shareholders, and to provide retained earnings for reinvestment.[6] It is important to clearly understand that it is the expected or required cash flow which is the cost of capital, not a percentage rate of return. It is due to problems associated with the direct measurement of the cost of capital that the percentage rate is often used in the estimation of the cost of capital.

2. COST OF EQUITY CAPITAL

Little academic literature on the cost of capital existed prior to World War II. Since that time there has been a rapidly growing body of research on the topic. However, to date, no single generally accepted theory has evolved. The single most significant barrier to the development of a cost of capital theory has been the difficulty in designing and conducting unambiguous empirical tests of the various competing theories. While the researcher has been able to observe the market price of securities he has not been able to obtain observations on shareholder estimates of future earnings or the discount rates they are applying to these earnings forecasts. Nevertheless empirical research has demonstrated that some theories have superior explanatory power than others. The following discussion will focus on those theories which are more generally accepted.

Cost of capital theories can be broken down into two groups, monetary and non-monetary theories. The monetary theories tend to be oriented to explaining the interest rate component of the cost of capital on a macroeconomic basis. These theories[7] are important in understanding the cost of capital for all financial instruments. However, they provide little of practical value when applied to an individual firm. Consequently, they will not be discussed in this paper. The focus will be on the non-monetary theories which have more applicability in determining the cost of equity capital. The diagram on the next page provides a schematic of the approach to be used to discuss the various approaches to estimating the cost of equity.

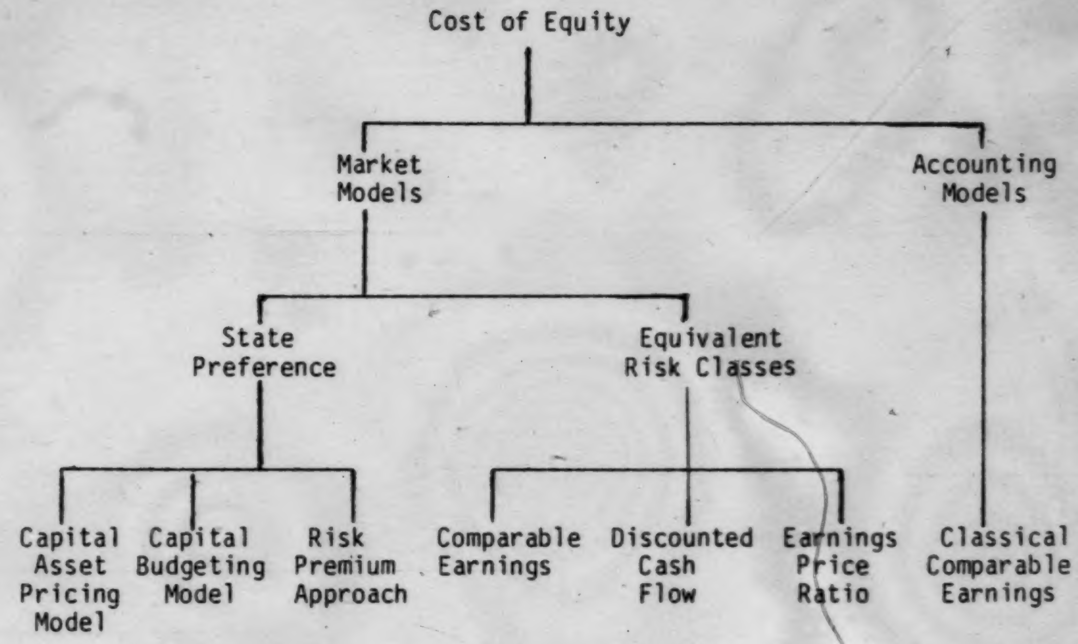
Cost of Equity
Market Models
Accounting Models
State Preference
Equivalent Risk Classes
Capital Asset Pricing Model
Capital Budgeting Model
Risk Premium Approach
Comparable Earnings
Discounted Cash Flow
Earnings Price Ratio
Classical Comparable Earnings

Diagram II-1

Non-Monetary Approaches to Estimating the Cost of Capital

In contrast to the monetary theories, the non-monetary theories "seek to determine the appropriate rate of interest without reference to possible changes in either the supply of money or its velocity. Rather, the rate of interest is established by the equilibriating of saving and investment decisions over time"[27,pp5]. Since most of the non-monetary theories of the cost of capital can be considered special cases of the state preference theory, the discussion will start there and proceed to the more commonly used capital asset pricing models and discounted cash flow models.

2.1. STATE PREFERENCE THEORY

This theory was developed by Hirshleifer[69]. The basic assumption of this model, and most modern financial models, is that all the wealth of society is ultimately held by individuals in the form of real resources. This wealth accrues in the form of an income stream to individuals who then divide this stream between consumption and saving. Since an individual's desired pattern of consumption will rarely coincide with their income stream, they are willing to trade claims on future earnings for present consumption. Securities present opportunities for these intertemporal shifts.

In the certainty case where there is a market rate of interest (r), an individual is able to exchange one unit of current consumption for (1+r) units of future consumption. From the production perspective, a unit of current consumption can be invested in a productive process to earn a return (i). The individual who wishes to save has the option of earning the market rate of interest (r) or a rate of return (i) from a productive process. In a perfect capital market[8] the actions of individuals will yield an equilibrium where the time preference rate for consumption (r) is equal to the rate of return on production (i).

In the uncertainty case it becomes important to recognize the time dimension inherent in securities. The uncertainty takes the form of not knowing what state of the world will be at some future date. However, the state preference theory assumes that for any given possible state, the pay-off of the security is known with certainty. Therefore, from the investor's perspective, "a security is a set of certain pay-offs, each associated with uncertain states of the world" [35,pp95]. When it is further assumed that investors are risk averse the theory is able to explain why investors will accept a lower average return on a riskless security and insist on a higher return on a risky security.

In order to make this theory operational two concepts of separation have been incorporated into the state preference theory. The first is the separation of the investment and consumption decisions and is known as the Fisher Separation Theorem [35,pp10].

> Given perfect and complete capital markets, the production decision is governed solely by an objective market criterion (represented by attained wealth) without regard to the individuals' subjective preference which enter into their consumption decisions

This theorem implies that production decisions can be delegated to managers because the individual can take the firm's output and adapt it to maximize their utility for present versus future consumption by trading in the financial markets. Stated differently, Fama and Miller [46] argue that, "in making its operating decisions an optimal policy for the firm is to maximize the market value of the holdings of its current owners, irrespective of the details of owner's tastes". If perfect certainty and perfect capital market can be assumed, then the market rate of interest represents the cost of capital to the firm.

The second concept of separation is portfolio separation. Portfolio separation requires that "the equilibrium price of risk be independent of individuals' utility functions or their risk preference"[35,pp112]. This concept is essential for empirical research. It leads to the assumption that there is one market price of risk for all individuals and that the riskiness of any given security is measured by its own characteristics in relation to the market, independent of an individual's risk preference. As will be clear later, this concept is essential for the capital asset pricing model. The state-preference model is useful as a framework for viewing investment decision by the firm and the individual. Both the capital asset pricing models (CAPM) and the capital budgeting models can be considered as special cases of the state-preference theory.

2.1.1. Capital Asset Pricing Model (CAPM): The capital asset pricing model is the newest and most popular of the mean-variance models[9] which evolved out of the state-preference theory. The mean-variance models were developed in order to provide a framework for analysis of the state-preference theory by defining measurable objects of investor choice. With investor's indifference curves assumed to be defined in terms of the mean and variance of asset returns, it is possible to use the variance to measure and price financial risk.[10]

The CAPM focuses on the relationship between risk and the required rate of return on equity capital. By assuming that current market values represent equilibrium prices for risky assets, the cost of equity capital is inferred directly from market data. This is done by first estimating the risk class(es) of the firm's investment opportunities and applying the current market price for each unit of risk to the company.

The CAPM in its basic form arose out of the efforts of Sharpe[130], Lintner[89], and Mossin[98]. In developing this partial equilibrium model of asset pricing, the following assumptions were made

a. All investors are single period expected utility of terminal wealth maximizers who rank risky prospects on the basis of mean and variance (or standard deviation).
b. All investors have identical subjective estimates of the means, variance, and co-variances of return among all assets; this is called homogeneous expectations.
c. All investors can borrow or lend an unlimited amount at given risk free rate of interest.
d. There are no restrictions on the short sales of any asset and the investor has full use of the proceeds of the short sale.
e. All assets are perfectly divisible.
f. There are no transaction costs of any form.
g. There is no personal taxation.
h. All investors are price takers.
i. The quantities of all assets are given.

The first assumption is the most important. Stated differently, the investor's objective is to maximize the expected value of his future income while minimizing its standard deviation. Therefore, an investor will purchase a portfolio of securities wherein each security contributes to the expected value of the portfolio's return, while, at the same time, decreasing the portfolio's risk.

The assumptions imply that every investor holds an efficient portfolio. That is, no other portfolio can provide the same or higher expected rate of return and lower risk. Furthermore, the assumptions make it possible to utilize two important concepts developed in portfolio theory in the CAPM. The first is the two-fund separation principle. This principle states that each investor will have a utility maximizing portfolio which is a linear combination of the risk free asset and a portfolio of risky assets. This principle leads to the second concept which is the capital market line. This is a straight line which, if all investors have homogeneous expectations, will be the efficient set of portfolios for all investors. It represents a linear relationship between portfolio risk and return.

The model requires a measure of risk. However, there is no consensus as to how risk should be defined and measured. The most often used measures of risk stem from Markowitz's work on individual portfolio selection. Markowitz postulated that investors balance the expected one period return on their portfolios against the variance of this return. To measure the risk of the portfolio he demonstrated that the risk of an individual security is proportional to the co-variance of that security with the portfolio. Since risk is reduced through diversification, increasing the number of securities in the portfolio results in the return on that portfolio becoming more closely correlated to the return on the market portfolio. This leads to the suggestion that the co-variance of an individual security and the market can be used as an indicator of the "systematic" or "undiversifiable" risk of a security.

The logical extension of Markowitz' concept of risk which leads to the CAPM is summarized in the CTC research report[27,pp11] and is restated below:

> Since the mean and variance of the portfolio return are functions of the means, variance and covariances of the constituent securities, the demand for a given security will be characterized by the mean and variance of its future return and its correlation with the future returns of other securities.

Building on the above relationship between risk and return, the CAPM states that the expected return on a security is related to its risk. Since the only risky assets held by investors are components of the market portfolio, it is appropriate to measure the risk of a particular security by its contribution to the risk of the market portfolio. Using this relationship it is possible to estimate the market price per unit of risk by observing market performance.

Stated mathematically, the expected return on security (j) in equilibrium is:

$$E(R_j)=R_f+[(E(R_m)-R_f)*\mathrm{cov}(R_j,R_m)/\sigma(R_m)] \qquad (2\text{-}1)$$

where:

$E(R_j)$ = the expected return on security j

R_f = the risk free rate of return

$E(R_m)$ = the expected return on the market portfolio

$\sigma(R_m)$ = the standard deviation of the returns on the market portfolio

$\mathrm{cov}(R_j,R_m)$ = the covariance between the returns on security j and the returns on the market portfolio

For purposes of this paper it is important to note that returns are defined to include all distributions (dividends, capital gains, interest, etc.) divided by the security's base price. The return calculated is on the market value of the securities held by the investors, not the book values.

Equation (2-1) can be reduced to its more common form by defining the risk of security j relative to the risk of the market portfolio as B_j.

$$B_j=[\mathrm{cov}(R_j,R_m)]/\sigma(R_m) \qquad (2\text{-}2)$$

Substituting in equation (2-2) allows equation (1) to be rewritten as follows:

$$E(R_j)=R_f+B_j[E(R_m)-R_f] \qquad (2\text{-}3)$$

B_j is the measure of the risk of security (j) measured relative to the total risk of the market portfolio. As such, Bj can be considered as the "systematic" or "non-diversifiable" risk of security (j). The expression $E(R_m)-R_f$ is interpreted as the market price per unit of "systematic" risk.

In addition to "systematic" risk, each security contains an element of unsystematic risk which is independent of (uncorrelated with) the variability of returns with the market portfolio. The unsystematic risk is caused by events or conditions specific to an individual security (e.g. a new product, a merger or acquisition, strike) that cause market revaluations of the security's share price.. It is the existence of this unsystematic risk which causes the beta coefficient to be unstable when it is computed for an individual security[53,pp4-5].

There have been many empirical tests of the CAPM[27,ppA-5 to A-17][78] to determine whether or not it provides an accurate explanation of capital market behaviour. One of the most comprehensive studies which supports the CAPM was conducted by Fama and MacBeth[46]. Their results showed that:

a. CAPM is a useful representation of risk and return in the capital markets,
b. while the CAPM model held on average over time, it need not hold any given point in time,
c. the value of the intercept were generally higher than the risk free rate, and
d. the relationship between risk and return is linear.

Most studies concentrated on short run expected rates of return of securities and yielded both substantiating and unsubstantiating evidence for the CAPM. The empirical tests, in general, of the CAPM have been questioned by Roll[126]. He argued that the CAPM studies have not achieved their objective of providing an unambiguous test of the model. In fact, he concludes that there is practically no possibility of testing the CAPM. According to Roll, the only testable hypothesis is that the market portfolio is mean-variance efficient. However, this requires the identification of the market portfolio, a task which still eludes researchers.

Another major problem with CAPM is the restrictive nature of the assumptions. Significant effort has been directed toward relaxing the assumptions underlying the model in order to improve the model's abilities to explain the structure of returns in the market. The two assumptions which have attracted the greatest amount of attention are the assumptions that individuals have quadratic utility functions and that the probability distribution describing the rates of return on all assets is multivariate normal. The assumption of quadratic utility implies that marginal utility can be negative while the assumption of the multivariate normal distribution implies that end of period asset prices can be negative.

Research efforts have also been directed at the other assumptions. Some of the areas examined include the effects of:[11]

a. restrictions on borrowing and lending opportunities
b. differential personal taxation
c. uncertain inflation
d. extending the model into a discrete time multi-period asset pricing model
e. extending the model into a continuous time asset pricing model

The relaxing of the original assumptions to approximate real world conditions does some damage to the original concept of the CAPM. In their submission to the Canadian Transport Commission's Cost of Capital Technical Committee, the Governments of the Provinces[111,ppII-11] observed that, "No longer is the risk-expected return relationship as hypothesized in the original formulation strictly valid; there are different relationships that explain the structure of expected returns in the marketplace."

In addition to the modifications of the CAPM to relax various assumptions, there are numerous variations of the basic CAPM model. Two of these, which incorporate adjustments for leverage in the firm will be presented here primarily because they are currently used by the Canadian Transport Commission in its cost of capital determination. The first of these incorporates the Modigliani and Miller theory[12] concerning the relationship between leverage and the cost of equity capital. To account for the added risk to the equity holder due to the added risk resulting from increased leverage, the Modigliani and Miller model results in an equity premium. The model is expressed mathematically below:

$$K_e=K_o+(K_o-r)(1-t)D/E+(K_o-r)P/E \qquad (2\text{-}3)$$

where

K_e = cost of equity capital for the levered firm
K_o = cost of equity capital for a firm financed by equity computed using CAPM
r = rate of interest on debt

t = corporate tax rate
D = market value of the firm's debt
E = market value of the firm's common equity
P = market value of the firm's preferred stock

The other capital asset pricing model used is the Canadian Transport Commission incorporates the Brian Belt adjustment. Like the Modigliani and Miller Model, this model increases the cost of equity when debt occurs in the capital structure. The model is presented in equation form below:

$$K_e=(R_f)+B_u(K_m-R_f)+B_u(K_m-R_f)D/E(1-t) \qquad (2\text{-}4)$$

where:

$$B_u=B/[1+D/E(1-t)]$$

K_e = Cost of equity capital for the levered firm
R_f = risk free rate
K_m = weighted return on the stock market
D = book value of debt
E = book value of equity
t = tax rate
B = beta for the firm under study

For both the Modigliani and Miller and the Brian Belt adjustments the CTC calculated beta using nine years of data. They also computed the betas using both a weighted and an unweighted scheme. The weighting system[13] put greater emphasis on current years than the first years of the study period. The time period used and the weighting scheme reflected the Commission's view that investors' expectations are more influenced by recent yields than longer term historical yields.

In summary, CAPM as a theory explaining the structure of returns in the marketplace may be correct. The model, however, remains to be proven empirically. Despite this problem, CAPM is used to estimate cost of capital in regulatory proceedings. In this regard Chapter Four will return to the CAPM to discuss some of the practical problems which arise when the model is applied to a specific security.

2.1.2. Capital Budgeting Models: Another set of models which have their basis in the state preference theory are the capital bugeting models. Using the Fisher separation theorem the capital budgeting models focus on production decisions. Production decisions are viewed as a set of capital bugeting decisions within which the cost of capital is considered a cost of production.

The capital bugeting models do not measure the cost of capital directly. Instead, these models define it as being the rate of return between the returns observed on submarginal and marginal projects. A submarginal project is defined to be a project with an expected rate of return just below the cost of capital to the firm. Similarly, a marginal project is defined to be a project with an expected rate of return slightly higher than the cost of capital. Therefore, by identifying the rates of return on projects undertaken by the firm and those not undertaken, it is possible to set upper and lower bounds on the cost of capital to the firm.

While capital budgeting techniques are widely used in project selection, this approach has not been widely used to estimate the cost of capital. In fact there have been relatively few tests of this model[86]. This does not mean the model is incorrect. The problem is that it is very difficult to test the model's ability to explain the structure of the capital markets.Since this model is used infrequently, if at all, in regulatory proceedings, it will not be discussed again.

2.1.3. Risk Premium Approach: Another set of commonly used models arising from the state preference theory are the risk premium models. These models focus on the components of the cost of capital and estimate each component separately.

These models are usually based on the following equation for the cost of equity (Ke):

$$K_e = \text{Risk Free Rate} + \text{Premium for Risk}. \qquad (2\text{-}6)$$

In its simplest form the risk free rate is estimated by using the current yield on treasury bills or government bonds. Therefore, the risk free rate contains both the real return required by investors as well as compensation for loss in purchasing power of the funds invested (inflation risk and interest rate uncertainty). The inclusion of the expected inflation risk in interest rates has long been recognized in economics and is known as the Fisher effect. Irving Fisher[50 pp358-60] argued that, under conditions of perfect certainty and perfect capital markets, investors would price financial assets to obtain a positive real rate of return. Consequently, the nominal rate of interest is deemed to contain two components: the real rate of interest and the anticipated rate of inflation.

In addition to the Fisher effect, the observed market return will also include a factor for the uncertainty associated with the future rate of inflation. This uncertainty component has attracted considerably more attention in recent years due to the wide spreads between real and nominal interest rates which characterize today's capital markets.

With the real rate of return and inflation risk accounted for in the risk free rate, the risk premium must take into account both the business and financial risk of the individual firm. Normally the risk premium is estimated by judgment, past history, or some other ad hoc method. Judgment is most often based on the evidence of credible participants in the capital markets. It is also possible to estimate the premium that has been realized over some particular time period for a given security or set of securities. However, the value of the premium tends to be unstable and not systematically related to the economic environment. This makes it very difficult to determine the risk premium at any given point in time. Other methods for estimating the risk premium used observed risk premiums on common equity over the long term yield on bonds of a company deemed to be in the same risk class as the firm being studied.[14]

Conceptually, the risk premium approach is an acceptable method of estimating the cost of equity capital. It is quite apparent that this approach is closely related to the capital asset pricing model described earlier. Being considerably simpler to calculate and present, the risk premium approach is extensively used to estimate the cost of equity at regulatory proceedings.

2.2. EQUIVALENT RISK CLASSES:

Another set of non-monetary approaches to cost of capital determination can be grouped together under the heading of equivalent risk classes. These models try to circumvent the problems of directly measuring risk.

Underlying these models is the assumption that, in perfect capital markets in a state of equilibrium, returns on securities with the same risk will have the same rate of return. Therefore, if two or more securities with the same risk[15] can be identified, the rate of return on one security may be considered the opportunity cost of not purchasing the others.

Three models will be described here, comparable earnings, discounted cash flows(DCF), and earnings-price ratios. The comparable earnings models are discussed first since the DCF models are a special case of these and the earnings price ratios are, in turn, a special case of the DCF models.

2.2.1. Comparable Earnings Test:

This approach to determining the cost of equity is similar to the accounting based comparable earnings tests described later. The difference is that the rate of return calculated for the comparable firms is a market rate of return rather than an accounting rate of return.

To conduct a comparable earnings analysis it is first necessary to find individual companies or groups of companies (a portfolio) which display the same risk as the company being analyzed. Both the concept and the measurement of risk are elusive. Therefore, it is quite common to use a number of risk measures. Some of the more commonly used measures of risk used are listed below[36,pp95-106 and pp191]:

a. Measures of earnings per share instability:
   1. variations in annual earnings per share relative to a long term trended value of earnings.
   2. standard deviation of earnings per share relative to a short term moving average.

b. Measures of share price instability
   1. maximum drop in share price over a twelve month period
   2. estimates of the systematic risk(Beta factor)
   3. variability of investor yields(Dividends or capital gains)

The first set of measures is based on the presumption that changes in share prices are generated in large part by revisions of investor's expectations concerning future earnings levels. Since share prices are determined by more than just earnings, these measures are an indirect measure of the investor's risk. Similarly, the share price instability measures directly the instability of the value of the funds invested in a firm.

There are obviously many other methods to measure risk. Consequently, it is not surprising that the identification of securities with comparable risk characteristics will vary with the method chosen. To minimize this problem some analysts construct composite measures of risk utilizing two or more methods.

Once comparable securities have been identified the market rates of return are then estimated. These estimates are developed using any of the previously identified methods or the discounted cash flow and earnings price ratios described below. In order to avoid circularity it must be assumed that prices of the securities being used as the basis of comparison are exogenously determined.[16]

For legal reasons to be described later in this paper, the comparable earnings approach is widely used in regulatory proceedings to estimate the cost of equity.

2.2.2. Discounted Cash Flow Model: The discounted cash flow (DCF) models avoid the difficulties encountered with the comparable earnings test by restricting the risk equivalent class to the one security under consideration. There are many versions of the DCF approach currently used to estimate the cost of equity. However, the majority are variations of the basic form of the model developed by John Burr Williams[154] in 1938 and its subsequent modification for regulatory use by Myron Gordon[59] in 1974.

The DCF models are based on the assumption that the capital markets are efficient and in equilibrium. Consequently, the yield on the security will equal the marginal return on direct investment. Under these conditions, the buying and selling actions of investors in the market place have priced the security relative to its risk and expected earnings. Hence, it is possible to limit the analyses to one security.

In equilibrium, it is argued, the market value of the security is the capitalized value of all expected future income from that security. Therefore, if one knows the market value and expected future earnings stream for a security, the rate at which future income is capitalized can be deduced. This relationship can be restated in the following form:

$$PV_0=C_0/(1+k)+C_1/(1+k)^2+.....C_n/(1+k)^n \qquad (2\text{-}7)$$

where

PV_0= present value of a stock
C_o, C_1 C_n = random cash flows from the stock expected by an investor in future periods (1 to n)
k = the investor's risk adjusted required rate of return

In order to make this model operational it usually assumed that the future cash flows relevant to investors are payments (normally dividends) for the corporation and the resale price of shares. If it is further argued that the sale of shares is simply a transfer of the right to any future payments made by the corporation, then the future stream of dividends is the relevant cash flow to use in the model. One further simplification is usually made when implementing the model. Rather than making discrete estimates of the dividend payout in future years it is assumed that investors have expectations of a growth rate for dividends per share. With these simplifications the model is rewritten as:

$$P_o=D_o/(1+k)+D_o(1+g)/(1+k)^2+.....D_o(1+g)^{n-1}/(1+k)^n \qquad (2\text{-}8)$$

where:

P_o = the market price of the security on the current period (n=o)
D_o = the dividend in the current period
g = the average expected rate of growth in dividends per share for the next n periods

Solving the above equation gives the following:

$$P_o=D_o/(k-g) \qquad (2\text{-}9)$$

Then solving for k:

$$k=D_o/P_o+g \qquad (2\text{-}10)$$

In addition to the assumptions described above, a number of other assumptions are required to make the transition from equation (2-7) to (2-10). These are outlined below[111,VOL II pp18-26][39,ppG7-11]:

a. Markets are rational and efficient so that PVo = Po

b. The term structure of risk free interest rates is flat and risk is resolved exponentially over time or k, is defined as the weighted average of Ko...Kn (the investors' risk adjusted one period required returns in period 1 to n).

c. Either investors have homogeneous expectations or Co...Cn and K represent the expectations of the marginal investor.

d. Shareholders expect the firm to have a stable retention ratio, and constant return on book equity, and a constant dividend payout ratio.

e. Investors are interested in the long term cost of equity.

While the formula for calculating the cost of equity is quite simple and data for Po and Do are readily available, it is the estimate of g that cause the greatest difficulty. Some commonly used methods are:

a. Extrapolation of historic trends in per share measures such as dividends, earnings, cash flows, or book values.

b. Brokerage estimates of future growth.

c. Calculation of the growth in book value per share which would be generated by assumed rates of return and retention ratios.

In using the historical techniques the time period should be sufficiently long to remove the impact of transitory influences but short enough to give weight to observations which reflect current financial characteristics of the firm. The latter estimating technique avoids some problems which occur when, during the estimating period, there is a major shift in the retention ratio.

An alternative is to measure growth as a function of the components contributing to growth. Growth can be expressed as the sum of retention financing and external equity financing. This relationship can be expressed as:

$$g=br+vs \qquad (2\text{-}11)$$

where:

b = expected retention ratio
r = expected average rate of return on equity investment
v = expected profitability of new investments to existing shareholders
s = funds raised from sale of stock as a fraction of existing common equity.

Quite often in practice the "vs" term is assumed to be zero reducing equation (2-11) to the more common form of:

$$g=br \qquad (2\text{-}12)$$

The important points to note here are that current dividends are earned by existing assets and that growth arises out of the investment of retained earnings or new equity when "v" is greater than "r".[17] This separation forms one of the critical elements of the funds flow analysis.

While the DCF models are extensively used in regulatory hearings [100,pp65-67], researchers have reached conflicting conclusions concerning the validity of the DCF models. A study by Copeland[58] in 1977 concluded that "except periods of market panic the model is a useful representation of the share valuation process". This conclusion confirms the work of Dr. Myron Gordon[59,Chapter 11] on the applicability of the DCF model to public utilities. On the other hand Walter Morton[96,pp259] concluded that, "the D/P plus G formula is logically incorrect for public utility regulation whenever stocks are selling at prices in excess of their book equity per share" and the net book value is used to measure the value of the firm. He goes to state that, "although it (the DCF model) purports to satisfy investor expectations, it is designed to defeat the expectations of any investor who pays a market price in excess of book".

It is not surprising that most of the research has focused on the problem of how to estimate future growth. Studies by Linter and Glauber, Brealy, and Levin[18] showed earnings growth rates are virtually random over time. An interesting study my Malkiel and Cragg[91,pp601-607] showed that security analysts were able to better estimate growth rates than a variety of historical trends.

Two DCF models are employed by the Commission; one using weighted and the other unweighted dividend growth rate estimates. The weighted growth rate utilizes five years data with the most current year given a weight of five and the oldest observation given a weight of one. Ten years of dividend data are used to estimate the unweighted growth rate.

Despite the conflicting evidence as to their ability to measure the cost of capital rate, the DCF models are widely used for both business and regulatory purposes. The attractiveness of DCF models arises out of their simplicity and intuitive logic. For purposes of this paper it is important to reiterate that these models focus on the cash flow to shareholders and the risk inherent in the cash flow.

2.2.3. Earnings/Price Ratio: The earnings/price ratios are simplified versions of the DCF models used under certain conditions to estimate the cost of equity. By assuming the opportunity cost to investors equals the marginal return to the firm and that the only source of growth in dividends per share is growth in book value per share generated by retained earnings, the DCF model (equation 2-9) can be simplified to:[19]

$$P_0=EPS_1/k \qquad (2\text{-}13)$$

where:

EPS_1 = earnings per share in subsequent period

P_o and k are defined as before.

Thus, solving for K, equation (2-13) can be written as:

$$K=EPS_1/P_o \qquad (2\text{-}14)$$

Since price is a function of both current and future performance, the assumptions are tenuous. If the company being analyzed is a no growth firm and pays out all its earnings as dividends, the assumptions might hold. Also the assumptions will hold if the company is regulated and the objective of the regulator is to keep the market value of the firm equal to its book value. These conditions are unusual. Most firms undertake projects which earn a return greater than the cost of capital. Where this is the case the earnings/price ratio will understate the cost of equity capital. Share prices will rise to reflect future earnings opportunities while the earnings per share estimate will not change. It is for this reason that this method is often used to set one of the lower limits for the cost of equity capital.

2.3. ACCOUNTING BASED APPROACHES TO THE COST OF EQUITY CAPITAL

So far the discussions has been of the non-monetary approaches to estimating the cost of equity capital. Consequently, they have been restricted to those which are based on market data. There are, in addition to these models, a number of approaches based on accounting data. Of the accounting based models only the "classical comparable earnings" approach is used to any great extent.[20] Therefore, the following discussion will be restricted to this approach.

2.3.1. Classical Comparable Earnings: The classical comparable earnings approach is based on a comparison of the earned returns of comparable firms calculated from their reported financial statements. This approach, as differentiated from the comparable earnings test described earlier, is based on accounting measures and not market measures. However, it is assumed here, as before, that the earned return of similar firms are a measure of the subject firm's opportunity cost.

Similar to the market based comparable earnings test there are two basic steps.

a. The selection of an appropriate group of companies with a comparable degree of risk as the subject firm.

b. For the comparison group calculate the average earned rate of return by dividing net earnings by shareholders equity (common stock at cost plus retained earnings).

The measurement of risk, as discussed previously, is a difficult and somewhat arbitrary task.[21] In contrast, the second step is very straight forward. The advantage of using accounting measures are as William Vatter[151,pp682] points out:

> " Accounting measurements are, at this writing, the only basic sources of data which establish (however imperfectly) the income for a period, the amount of investment, and the bases of classification and matching the rate of return currently being realized by operations or projects in which we are interested"

In using this approach it is generally recognized that the observed rates of return are average returns earned on past investments. Consequently, this measure can only equal opportunity cost in a state of long run equilibrium in a perfectly competitive market. Under these conditions marginal returns will equal average returns.

A number of authors have criticized the use of the accounting rates of return primarily because they are biased upward[39,pp353]. Soloman[138] conducted a comprehensive analysis of market and book rates of return as measures of prospective performance and required rate of return. This study argues that the disparity between the market and book measures is a function of the firms growth, the average maturity of its assets, its depreciation and capitalization policy, inflation, and other factors.[22] From his analysis Soloman[138,pp80] concludes that "the rate of return in conventional book rate units is conceptually and numerically different from the rate of return in DCF units," and that "two companies with similar DCF rates of return may well show widely differing book rates of return".

Even though this method has very weak theoretical support and does not produce, except by coincidence, an opportunity cost, it is still widely used in regulatory proceedings. The reason, as will be shown in the next chapter, is the jurisprudence governing regulatory commissions.

3. COST OF DEBT CAPITAL

In contrast to the cost of equity, the measurement of the cost of long term debt[23] is relatively straight forward. There are some practical problems such as the appropriate rate to use on convertible debt and the procedure for calculating the cost of debt denominated in a foreign currency. Resolution of these problems is not without controversy but the impact on final estimate of the weighted average cost of capital is small.

Two different approaches to measuring the cost of debt are used, the embedded cost and the marginal cost of debt. The approach which is used is determined by the purpose for which the cost is being estimated. Where a measure is required of the actual dollars paid out in interest, the embedded rate is used. The embedded rate is calculated by taking the interest payments (coupon rates) in a particular year and dividing this by the average book value of debt outstanding in that year.

Where the opportunity cost of debt capital is desired, the current market rate is used. This can be estimated in a number of ways. The first is to use the effective interest rate on a recent debt issue sold by the company. Another method is to calculate the effective yield to maturity on the companies debt securities which are not close to maturity.[24] The CAPM has also been used to estimate current debt costs. A fourth method is to rely on the informed judgment of security dealers. When calculating the average market yield, common practice is to take into account the cost of issuance when computing the rate at which new debt could be floated.

These and other methods for estimating the marginal cost of debt assume the capital structure of the firm remains relatively constant at a target debt/equity ratio.[25] If this assumption is not valid estimating the marginal cost of debt can become very much more difficult. For purposes of this paper the capital structure will be taken as given.

4. COST OF PREFERENCE SHARES

The procedures for calculating the cost of preference (or preferred shares) are virtually the same as for debt. Like the cost of debt, either the embedded or marginal cost may be appropriate.

In the case of preference shares the only commonly encountered complication occurs with the computation of the embedded rate. The problem is caused by preference shares issued at prices greater (or less) than the stated par value. To calculate the proper cost to the firm, the net proceeds from the issue should be used. As preference stock has no maturity date, its cost may be calculated by the following formula:

$$K_p = D_p / I_o \qquad (2\text{-}15)$$

where:

K_p = cost of preference stock equity
D_p = stated dividend per year
I_o = net proceeds of the stock issue

It is quite obvious that equation (2-15) is the same as Gordon's divided growth model described earlier (equation 2-10). The difference is the omission of the growth rate which is not a factor with preference shares.[26]

5. MARKETS VS BOOK WEIGHTS

In most instances, investment projects are financed out of a pool of funds as opposed to being individually financed out of debt, preference shares, common equity etc. Therefore, the appropriate capital cost is the weighted average of the various sources of funds used to finance the company. The costs of the various sources of funds has been discussed above and the weights for each reflect the proportion of the total capital attributable to the specific source of funds. In calculating the weights two conceptual approaches can be used. The first calculates the weights based on book values of the securities while the second uses the current market values as a base for the weights.

Book value weights are calculated by dividing the book value of the security by the total book capitalization of the company. This weighting scheme is preferred by most companies and regulatory bodies, as the appropriate approach for purposes of computing the cost of capital if two key assumptions hold. First it must be assumed that the target capital structure for the firm is represented by the book value weights and, second, that any new investments do not significantly differ in systematic risk from the risk for the firm. Book weights tend to be more stable over time and are thought to better represent management's decision on its optimal capital structure.

Proponents of market weights argue that such weights are appropriate for the measurement of the marginal cost of capital (opportunity cost)[28,Volume 2, pp38-40]. There are three major alternative methodologies for measuring the market weights. In the first approach, market weights are defined as marginal weights. The proportions used are based on the proportions of various financial instruments to be used to finance the next project. This approach has practical problems caused by the 'lumpiness' of new capital generation. In a particular year it is possible that a firm would raise 100 per cent of its new capital through an equity issue. As a result, project selection criteria would be distorted toward those with higher rates of return and those with shorter project lives.

Market value weights can also be calculated by dividing the market value of the security by the market value of the firm (i.e. the sum of the market value of the outstanding securities). The weights calculated by this approach can be unstable and misleading particularly in periods of uncertain capital markets. For example, when interest rates are rising the market value of the bonds will decline. Multiplying the higher interest rate by the lower market value of the bonds results in some degree of cancellation. However, the cancellation is not normally complete and the relative proportions in the capital structure shift. These shifts are a result of market impacts and not necessarily a change in the corporate financing policy.

The third general method for assigning market weights is based on Modigliani and Miller's[94] interpretation. They argue that a firm has a target debt to market value ratio and this is the relevant ratio irrespective of how a particular investment is financed. The market value is defined as the market value of the investment in the marginal project (replacement value). Alternatively, Haley and Schall[62,pp306-311] argue that the market value should be measured by the present value of the cash flows expected from the marginal project (reproduction value). This latter measure is acknowledged as being a conceptually better measure[35,pp281]. However, it should be noted that if the project is truly at the margin in the economic sense, then replacement value equals reproduction value.[27]

The use of book or market weights is obviously controversial and closely tied to the selection of the appropriate asset valuation for the calculation of the cost of capital. Up to now the cost of capital rates have been expressed as percentages. In order to calculate the cost of capital these rates have to be applied to an asset value. Obviously the measurement of the asset value should be consistent with the weighting system used to calculate the firms' cost of capital. It will be shown later there are appropriate combinations of market and book weighting schemes depending on the various asset valuation methodologies used.

6. DIVISIONAL COST OF CAPITAL

The cost of capital of interest in this paper is that for CP Rail and CN Rail. Both of these organizations are divisions of a parent company and, as such, do not issue their own securities to finance their investments. As a result, there is no observable market determined cost of capital.

The obvious, and sometimes practical, solution to this problem is to just use the cost of capital for the parent as being appropriate for the division. This approach is valid if it can be demonstrated that the division has the same risk as the parent. Another argument offered in support of this solution is that, since the parent company raises all of the capital, the cost of capital for the parent company is the appropriate cost for all divisions irrespective of their risk. This line of argument is faulty because such an approach would cause the high risk divisions to accept projects they should not undertake and low risk divisions to reject projects they should undertake.

There are various methods which can be used to estimate a division's cost of capital. One of the most common is a variation of the comparable earnings test described earlier. Instead of using companies with similar risk to the firm as a basis for comparison, companies with similar risk to the division are used. The cost of capital for these comparable firms can be calculated using any of the approaches which have been discussed (CAPM, DCF, etc.). One major difficulty is there is no obvious set of risk criteria. With no market data for the division available, accounting based measures must be used. One such measure is the variation of division revenues. Another measure is the variation in earnings before interest and taxes[36 pp100-103]. Unfortunately, many costs are allocated to a division and hence likely depart significantly from the costs which would exist where the division is a separate entity.

Another approach to estimating a division's cost of capital is to estimate the cost of capital rate for the traded shares of the parent company and make appropriate adjustments for any differences in risk which may exist between the parent and the division. These adjustments can be made for business risk or financial risk or both. Business risk adjustments are normally based on the variability of the divisions earnings relative to the parent. The determination of the appropriate adjustment can be done using techniques ranging from informed judgment to special versions of the capital asset pricing model where beta is expressed relative to an earnings measure. If the division has a capital structure which is different from the parent then an adjustment should be made to the parent's cost of capital to reflect the different financial risk. The mechanics of any such adjustment is very complex and beyond the scope of this paper.[28]

The third and final approach to be discussed here is one which is applicable to a parent company such as CP Ltd. It has both divisions and a publicly traded subsidiary. In this case it is possible to calculate the cost of capital for the divisions by creating a relationship between the required rate of return of the parent and its two sub-components. If there is no off setting diversification affect, then the return on the parent's equity is the weighted average of the return on the division and the subsidiary. Since the returns on the parent and subsidiary can be measured, it is possible to solve for the required return for the division. The effects of diversification can be taken into consideration provided a measure of risk can be found.[29]

There are other methods which have been used to measure the cost of capital for a division. However, the above examples serve to illustrate that the principles and procedures for estimating divisional cost of capital are the same as those for parent. The key variable is the relative risk of the parent and the division.

7. SUMMARY

This Chapter has explored the theory behind the cost of capital and the various methods used to estimate it. Although there have been significant advances in the development of financial theory in recent years, the development of a theory which is able to explain and predict the cost of capital remains an elusive objective. The difficulty is primarily with the cost of equity capital. Measurement of the cost of equity is complicated by the inability to obtain unambiguous measures of the cost from the marketplace to use as a basis for ascertaining the predictability of the various measurement techniques. It is, therefore, not possible to say that one model is better than the other. Faced with this situation, common practice is to use a mixture of the various models in combination with informed judgment to estimate the cost of capital to a particular firm.

Even though there are various approaches to measuring the cost of equity capital, there are some important elements which are evident in all the approaches. These are summarized below:

a. The cost of equity capital is an opportunity cost. Accepting capital markets to be efficient, the investors' ability to buy and sell his securities within a risk class ensures the return on a particular security reflects the alternative opportunities available.

b. The cost of capital (both equity and debt) is a dollar cost not a percentage. The percentage is really the cost of capital rate which must be combined with some measure of the funds invested in order to compute the cost of capital.

c. In almost all the models[30], the cost of equity capital is a market determined rate of return. The monetary theories view investors as buying a stream of future income. This income stream may be more or less risky than other income streams and the price investors pay for the security will reflect the risk. Consequently, it is only by accident that the market value of a company's common equity will equal the book value of equity.

d. The cost of equity is always an ex ante concept whether it is measured using past data or future projections. There is no coupon rate or term to maturity such as the case with debt instruments. Equity is bought and sold continuously. As a result investors always have a forward looking perspective.

The various market based models employed to measure the cost of equity use quite different approaches. For example, the CAPM measures the price of a unit of risk, whereas the DCF model solves for the discount rate which equates current market prices with expected future income streams. However, they have important common elements. The cost of capital rate calculated is the required rate of return on the market value of the security. Another common element of these models is described by Bonbright[12,pp260].

> --current cost of equity capital is rarely identified with spot costs. Instead, it is taken to mean a normal or average capital attracting rate of return characteristic of the market of the past several years and typical of the market anticipated in the not too distant future.

Despite their short-commings, the accounting based models continue to be used in regulatory applications to measure the cost of capital. The reasons for this are mainly legal and will be discussed in the next chapter.

At the start of this paper it was stated that the cost of capital and rate of return are similar concepts but different in some ways. The next chapter will build on the material presented here on cost of capital to explore the regulatory theory behind the fair rate of return concept. It will be shown that, in theory, the cost of capital is the major input into the determination of the fair rate of return.

ENDNOTES

1. It will be shown later that there is considerable disagreement about how the monetary value should be measured.

2. Government can be perceived as a user when subsidized services are produced.

3. This definition is based on the concept of maintaining the financial capital of investors. To maintain financial capital the cash flow generated by an investment must be sufficient to return the capital invested and an expected level or return on capital invested which reflects all aspects of risk inherent in the investment including inflation risk. The conflicting view is the maintenance of physical capital where in the cash flows generated by an investment must be sufficient to replace the physical unit(s) of production. Further discussion of the concepts of physical and financial capital are found later in this paper and in K. Shwayder[132].

4. The literature examined regulatory proceedings for utility and transport companies and included end uses such as rate setting, subsidy, abandonment, and individual rate cases.

5. The value of capital assets held by the investor will be discussed later but, for now, suffice it to say that the valuation can be either some measure of the market value of the securities or a measure of the value of the physical assets used by the firm.

6. Dividends paid and retained earnings are inter-related. A firm may make a decision to pay out all retained earnings as dividends and use external capital for investment.

7. These theories include the liquidy preference, term structure of interest rates and the loanable funds theories.

8. To be perfect a capital market has to exhibit perfect information, no transaction costs and no monopolistic elements.

9. The mean variance models will not be discussed in this paper except in the context that the work done on these models is incorporated into the CAPM. Most of the mean variance models have been used in portfolio theory and have not been adopted to directly measure the cost of capital.

10. Financial risk is defined as the portion of total corporate risk over and above basic business risk (uncertainty caused by price changes, demand shifts, etc.) that results from using debt financing. This risk can not be diversified away by holding a portfolio of securities.

11. For a synopsis of this research see the summary contained in the Provinces submission to the CTC Technical Committee reviewing the Cost of Capital for Canadian railways.[111,Appendix One,pp6-26].

12. Modigliani and Miller argue that, in an environment with no taxes, there is no optimal capital structure. This implies that any reduction in the overall cost of capital achieved by increasing the debt component is matched by a corresponding increase in the cost of equity.

13. The most recent year was given a weight of nine with the weights decreasing to 1 for the first year of the series.

14. This should not be confused with the comparable earnings methods which are very similar.

15. Equivalent risk is normally defined as having approximately the same probability distribution of future returns.

16. If the return on security A is the opportunity cost of funds invested in security B and the return on security B is the opportunity cost for security A, then the prices of security A and B cannot be determined simultaneously.

17. Outside equity will be of benefit to the existing equity holder only if the average rate of return from assets purchased with the new equity is in excess of the cost of equity capital.

18. Results of these studies are summarized in R.L. Hagerman[61,pp18-19].

19. For proof see CP Rail[39,ppG11-12].

20. In 1975 the National Association of Regulatory and Utility Commissioners (NARUC) reported that more than 50 per cent of the states relied upon or accepted the use of the comparable earnings standard.

21. Myers[100] points out that there is no definitive theory about how risk should be related to differences in book rates of return (or even how risk should be defined if the book rate of return is the variable of interest).

22. Other factors which have been identified are differences in the lags between investment and cash inflow, the timing and patters of cash inflows, the fraction of working capital to total capital, and the percentage of a capital investment which is expensed.

23. Short term debt is usually considered part of working capital and will not be discussed in this paper.

24. When taxes, bond price discounts and premiums, underwriting costs, and other bond features are taken into account the formula can become quite complicated.

25. The process of raising new capital tends to be lumpy causing year to year variations about a target capital structure.

26. Participating preference shares are the exception.

27. At the margin, the present value of the cash flows discounted at the cost of capital is the value of the investment outlay.

28. The debate started with Modigliani and Miller's 1963 article and has continued on since then.

29. An example of this type of analysis can be found in: Governments of the Provinces[111,Vol.2, pp35-45].

30. The accounting based models are the major exception.

CHAPTER III

REGULATION AND A FAIR RATE OF RETURN

Canadian railways, like many other companies are influenced in their business activities by various forms of regulation. Within the Canadian political philosophy, private business activity is the primary vehicle for achieving the economic goals of the country. Regulation is a policy instrument used by government to influence business activity toward its broad economic, social, and political objectives. Consequently, regulation must be viewed as a concept which goes beyond economics to encompass legal and political considerations.

Broadly defined, regulation includes "taxes and subsidies of all sorts as well as explicit legislative and administrative controls over rates, entry and other facets of economic activity"[110,pp335]. As pointed out in Chapter I this study focuses on railways and the subsidy and rate control aspects of their regulation. It is in these two areas where the measurement of the cost of capital directly affects the revenue earned and decisions made by the regulated firm.

One of the basic axioms of regulation is that government, through its intervention, will not confiscate the capital of the regulated firm. Investors in regulated companies are, in almost all cases, ensured a rate of return on invested capital at least equal to the cost of capital to the firm[1]. This last statement is critical to understanding the relationship between the cost of capital and the fair rate of return concepts. The allowed rate of return may or may not equal the cost of capital. There are two reasons for this. The first reason is that financial theory has not developed to the point where the "actual" cost of capital to a firm can be measured. Consequently, a regulator in an effort to ensure investors are fairly treated, may set the rate of return at a level higher than that estimated for the cost of capital. The second reason is that the regulator may deem it necessary to set the allowed rate of return at a level greater than the cost of capital to ensure that other goals of regulation, such as efficiency and adequate capacity, are also achieved. Therefore, the cost of capital and fair rate of return concept are highly interrelated wherein the cost of capital could be viewed as a subset of the "fair rate of return" concept.

One of the criteria adopted for evaluating the funds flow methodology was that it has to be theoretically sound. Because one of the proposed uses of the funds flow approach is as a procedure for determining the "fair rate of return" for Canadian railways, it must be acceptable as either a direct measure of a "fair rate of return" or as a measure of the cost of capital which then, in turn, used by the regulator to set a fair rate of return. Obviously, where a fair rate of return is equated to the cost of capital, the funds flow approach could meet both theoretical criteria simultaneously.

The purpose of this chapter is to continue the process of establishing a theoretical basis for evaluating the funds flow methodology. This requires an examination of those aspects of the theory of regulation which guide the determination of a fair rate of return. Because the cost of capital is the single most important input into the determination of the fair rate of return, much of the discussion in this chapter will be built on the preceding chapter. In order to simplify the presentation of the theoretical principles behind the fair rate of return, it will be assumed throughout most of this chapter that the cost of capital computed as a percentage rate of return is known.

Like the previous chapter the final section of this chapter will draw out a number of theoretical and practical principles which will be used to evaluate the funds flow methodology. To accomplish this the material presented in this chapter examines the theoretical, legal, and social aspects of rate of return regulation. In addition, the latter part of the chapter examines the rate base rate of return formula which is almost universally used to compute the return on investment allowed a regulated firm.

There is very little information directly pertaining to fair rate of return in the railway industry. Therefore, it was necessary to base most of this chapter on literature and studies concerning public utility regulation. Even though the railways are not regulated in the same manner as public utilities the basic underlying principles in so far as fair rate of return concepts are concerned, are very similar. Subsequent chapters will point out some significant differences in the regulation between railways and public utilities. However, for purposes of understanding the material contained in this chapter, it is sufficient to say that both systems of regulation require that an estimate of a fair return on investment be included in cost computations.

1. THE GOALS OF REGULATION

Earlier in this paper it was stated that a firm must receive a return at least equal to its cost of capital if it is to remain viable in the long term. It was also stated that, in order for this to occur, the rate of return allowed by a regulator must equal or exceed the cost of capital. Up to this point the discussion has focused on the cost of capital estimation problem. Now the focus shifts to the process of setting a fair rate of return by a regulatory body. It must be first realized that regulators are guided by numerous factors which go beyond the principles of economic efficiency underlying cost of capital estimation methodologies.

If the rationale for regulation were purely economic it would be relatively easy to establish the objectives to be used by the regulatory agency in setting a fair rate of return. The reality of the situation is that regulations are established for a variety of purposes. Therefore, it is necessary to understand the goals of the regulatory system in order to gain an appreciation for what is meant by "fair" in the fair rate of return concept.

While economic efficiency considerations are important they are, in themselves, insufficient to explain the myriad of regulations which exist. In today's mixed economy many companies and organizations are subject to regulation in some form or another. It is not unusual to find companies engaged in the same business in different geographic areas subject to different forms of regulation. This situation occurs for two reasons. The first is that the two companies may not be regulated for the same reasons and the second is that, even if they are regulated for the same reasons, the regulators may not agree as to how best to achieve the regulatory objective.

There has been considerable research into the rationale for the myriad of regulation that are observed in the economy. Posner[110] compares and contrasts two of the more popular theories of regulation. The first is the traditional public interest theory. This theory argues that regulation is supplied to protect the public from exploitation by natural monopolies or to correct for the effects of externalities. Regulation of natural monopolies[2] such as electric utilities, telephone companies, etc. can be explained quite readily by this theory. However, it is not sufficient to explain the wide variety of regulation which currently exists.

A second theory of regulation identified by Posner is called capture theory. This theory based on work by George Stigler[146,pp3-21], argues that regulation is supplied in response to demands of interest groups attempting to maximize the incomes of their members. Thus, economic regulation serves the private interests of politically effective groups. As such, regulation is viewed as commodity which has economic value and, consequently, a supply and demand function. Criticism of this theory focuses on its failure to completely explain public interest regulation such as, in the case of railroads, level crossing protection, dangerous goods, and equipment safety regulations. These exceptions from either of these two theories have their basis in society's values which are brought to force through the political process.

Kaysan and Turner[80,pp189] take a broad view of situations which can result in some form of regulation. They offer the following three general situations where regulation arises:

a. Situations in which competition, as a practical matter, cannot exist or survive for long, and in which, therefore, an unregulated market will not produce competitive results (e.g. few competitors).

b. Situations in which active competition exists but where, because of imperfections in the market, competition does not produced competitive results (e.g. ruinous competition).

c. Situation in which competition exists, or could exist, and has produced or may be expected to produce competitive results, but where in light of other policy considerations competitive results are unsatisfactory in one or more respects (e.g. public policy goals).

Irrespective of which theory of regulation is ascribed to, they attribute the creation of regulations to a combination of economic, social, and political factors. As a result, if the regulations are to be effective, they must be administered and evaluated in relation to the factors which led to their creation. This is normally accomplished by putting the regulations into a legal framework which defines the objectives of the regulation, the areas to be regulated and the general criteria to be used by the regulator[3].

Now looking more specifically at the rate of return (cost of capital) issue, it is a pervasive element in contemporary regulation arising wherever regulations are established to control prices, to assess disinvestment and investment decisions, and to provide fair compensation for the provision of uneconomic services. The administration of such regulations requires the resolution of the conflicting goals of the public interest and the regulated enterprise in setting the rate of return. Over the years regulations and, as will be shown later, jurisprudence have developed to guide regulators in this matter. The more important of these criteria are now presented starting with the public interest perspective. According to Baumol[3], regulation should accomplish the following if it is to serve the public interest:

a. The prevention of monopoly profits without at the same time, precluding the profitable operation of the company.
b. The reduction as far as can reasonably be expected of the missallocation of resources and the distortion of demand patterns resulting from the administratively determined rates for the various company services.
c. The provision of strong motivation for operating efficiency and innovation.
d. The prevention of predatory competition in those product lines which are not provided under monopolistic conditions.
e. The protection of consumers of company services whose demands are inelastic from the burden of inefficiencies in other portions of the company's operations.
f. The elimination of the motivation for uneconomic investment as a means of expanding the rate base[4].
g. The preclusion of the use of other socially undesirable means to expand the rate base[5].

From the perspective of the industry which is regulated, it will be argued that regulation should[6]:

a. Assure adequate earnings so that the regulated industries can continue to develop and expand.
b. Maintain the company's financial integrity[7].
c. Compensate the company's investors for the risk assumed.
d. Provide a return commensurate with that earned by other enterprises of corresponding risk.

The balancing of these conflicting goals in a regulatory context is very difficult. If only economic criteria were used there is a widely accepted minimum condition which, if met, reconciles these conflicting goals from an economic efficiency basis. Nelson[105,pp4] argues that the earnings allowed investors should be based on yields required on the market value of the company's securities. Such a condition would protect the public interest and ensure that there can be attraction of capital without sacrificing the integrity of the investors' position. Unfortunately, these required yields (the market cost of capital) have, to date been very difficult to measure in an unambiguous way. Also, the reality of regulation requires that more than economic criteria enter into the decision making process. Consequently, the term fair rate of return of often used to describe the rate of return permitted by regulators when all factors are taken into consideration. The next section of this chapter focuses on the problems associated with setting a fair rate of return.

2. FAIR RATE OF RETURN

By now it should be apparent that the rate of return set by regulators may not always equal the cost of capital. In fact, there is no single rate of return just a zone of reasonableness. This zone is bounded on the lower limit by the goal of economic efficiency and on the upper end by non-economic goals. The logical starting point is, therefore, to examine the fair rate of return concept where economic efficiency is the only criteria.

2.1. ECONOMIC EFFICIENCY CRITERIA FOR RATE OF RETURN DETERMINATION

In the economic context, regulation is a surrogate for competition and as such would ideally result in a perfectly competitive solution with price equalling marginal cost. Since costs in the economists definition include the opportunity cost associated with the capital funds provided, the rate of return should be set equal to the marginal cost of capital.

The various market based models presented in Chapter II demonstrated how finance theory can be used to measure the marginal cost of capital. As stated earlier, the cost of capital observed in the market place reflects the minimum return required by investors on the last (incremental) project undertaken by the company. If the regulatory objective is to preserve for the public, instead of the producer, the benefits arising from legal monopoly without depriving the investor of a competitive profit[97,pp94], then the rate of return should be set equal to the cost of capital. In using the cost of capital as the rate of return it must be recognized that it is the long run equilibrium conditions which are of interest. Thus, Myers[100,pp80] concludes that: "Regulation should assure that the average expected rate of return on desired new investment is equal to the utility's cost of capital". He further concludes that, "rate of return regulation should be based on finance theory and the cost of capital concept".

If the regulator's goal was to duplicate the results of perfect competition it would be sufficient to set the rate of return equal to the marginal cost of capital. This would yield the optimal level of output at the lowest price.

There are, however, a number of conditions which exist in the market place and regulatory environment that cause the regulator to deviate from the ideal. These conditions which are pervasive in today's mixed economy have to be taken into consideration in setting the allowed rate of return. Where an industry has a declining average cost curve the Pareto optimal output (price equals marginal cost) cannot be achieved without a subsidy. This situation is illustrated in the diagram on the following page. If price is set equal to marginal costs the firm cannot generate sufficient revenue (price=P_1 and output =Q_1) to cover total costs. Under these conditions, optimal outputs can be achieved only if some arrangements can be made for the absorption of the negative rents through social action. If the marginal cost of capital were to be used without any form of a subsidy, there

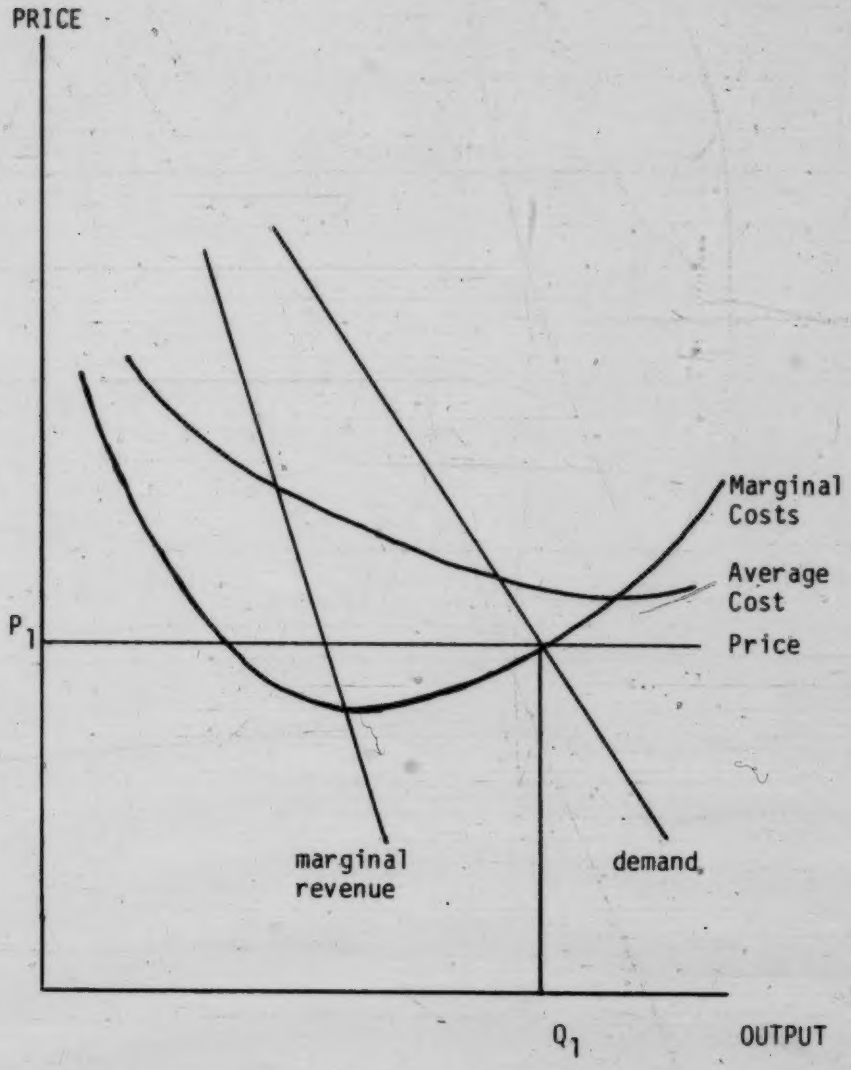
PRICE
Marginal Costs
Average Cost
Price
P_1
marginal revenue
demand
Q_1
OUTPUT

Diagram III-1

Equilibrium Conditions With Imperfect Competition would be no incentive to invest in the firm to operate it efficiently.

As Lerner[88,pp24] points out, regulators often taken the approach of setting price equal to average cost.

> The widespread acceptance of....the principle that price ought to be equal to average cost (including a fair return on the capital invested) seems to be based on a fusion of the capitalistic (ideological and practical) antipathy to losses with the socialistic (purely ideological) antipathy to profits.

The difficulty is that, with prices set equal to average costs, the optimal level of output would not be produced unless marginal cost equals average cost.

Another problem which arises is that setting price equal to marginal cost yields optimal allocation of resources only if such a pricing system is being followed uniformly throughout the entire economy. The existence of pervasive imperfections in the economy such as monopoly, taxes and subsidies, greatly complicates the problem of efficient pricing. Kahn[79,pp44] points out the problem these imperfections cause when setting the rate of return:

> If perfect competition does not prevail in the real world, non regulated industries generally may earn more (or less) than the minimum return. If so, it would produce missallocation to hold the prices of regulated services down (or up) to that level.

This situation is often referred to as the problem of "second best". Ideally, the rate of return decision should be determined through a general equilibrium analysis which takes into account all the ways in which that equilibrium would be altered by the adoption of any particular rate of return for the firm under study. While theoretically correct, Baumol[3] points out that it is a totally impractical task. However, he argues that it is not impossible to make informed judgments about the ways in which the most directly relevant imperfections elsewhere might suggest modifications from the price equals marginal cost rule.

There are many other economic reasons why it may be necessary to deviate from setting price equal to marginal cost[79,pp83-86] but only one more will be presented here as being relevant to the topic of this paper. Many North American industries including railways, have excess capacity. In these circumstances, firms are most likely operating at a point where marginal cost is less than average total costs. Often this is only a short-run problem but in a number of industries which are declining or have long-lived assets this can be a long term problem. Consequently, if they based their prices exclusively on marginal costs, they would have to find some other means of making up the difference.

Resolution of this problem requires a regulator to decide who will bear the burden of the excess capacity, the investors (equity holders in particular) or users. The most common instance of this problem arises in the electric utility industry. Here, capacity is added in large incremental units primarily to achieve an optimal sized plant. If the new capacity was immediately utilized there would be no problem in including the value of the new plant in the asset base and allowing a return on it. However, it often takes a few years to utilize the new facility to its optimal capacity. Therefore, the regulator must decide what proportion of the asset value a return should be allowed.[8] While there are numerous instances where this has been done in the United States there have been only a few instances in Canada[104][107].

Excess capacity can also result from a drop in the demand for service below current levels. In some instances[103] this has prompted regulators to reduce the asset base and consequently the allowed rate of return. When the regulatory framework of the Canadian railways is discussed in subsequent chapters, it will be shown that serious problems arise out of the existence of excess capacity.

Regulated companies do not exist in a perfectly competitive world. Consequently, the economic criteria for rate of return regulation cannot be stated simply as setting price equal to marginal cost. Other economic factors will likely cause the regulator to have to deviate from this condition. This is not to say that the price equals marginal cost criteria should be discarded. It is an essential basis. Deviations from this basic condition are judgmental in nature and, therefore, require a reference point.

2.2. LEGAL CRITERIA FOR RATE OF RETURN DETERMINATION

In addition to the economic arguments presented above, there are legal reasons why regulators do not always set the rate of return equal to the marginal cost of capital. Both in Canada and the United States there have been numerous legal interpretations of "fair return". The most often cited legal decision is the one given by the U.S. Supreme Court in 1944 in the Hope Decision[48],

> The return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risk. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital.

Canadian jurisprudence has closely paralleled that of the United States' courts. As far back as 1929, the Supreme Court of Canada[106,pp192] commented on the criteria which should govern the determination of a fair rate of return:

> The duty of the Board was to fix fair and reasonable rates; rates which, under the circumstances, would be fair to the consumer on the one hand, and which, on the other hand, would secure to the company a fair return for the capital invested. By a fair return is meant that the company will be allowed as large a return on the capital invested in its enterprise (which will be net to the company) as it would receive if it were investing the same amount in other securities possessing an attractiveness, stability and certainty equal to that of the company's enterprise.

These legal decisions provide regulators with some general criteria to be used to test whether the allowed rate of return is fair. Christy and Christy[32,pp24] identify the following four tests which are implied in the legal decisions cited above.

> the return should suffice (1) to maintain the utility's financial integrity, (2) to provide a return commensurate with that earned by other enterprises of corresponding risk, (3) to compensate the company's investors for the risk assumed, and (4) to attract capital to the utility.

Strict adherence to these criteria would cause the regulator to come face to face with some very difficult economic and financial problems. However, in practice, most of evidence presented has been focused on the capital attraction criteria[32,pp26]. Through the use of the various cost of capital models described earlier, estimates are presented on the level of return necessary to attract funds to the company. While this criterion is probably the most important and is consistent with both economic and financial theory, it does not present the whole story. Bonbright[12,pp158] reiterates this point.

> ...the standards of reasonable rates are multiple standards, and that all of them at times come into conflict with one another....In the determination of the rate levels, capital attracting adequacy is properly considered a (not the) basic test of a fair return.

It is useful to explore the other legal criteria in order to appreciate the issues involved and the difficulty in their implementation.

2.2.1. Financial Integrity: Financial integrity is not often referred to in regulatory proceedings because there is no generally accepted operational definition. It normally only arises where the existing or proposed rate of return imperils the companies bond or credit rating. In its broadest context, financial integrity has three components (1) integrity of assets, (2) integrity of earning power and (3) integrity of capital. These three components can be examined separately or together. Separately, "benchmark" measures can be developed for each of the components. Christy and Christy[32,pp29] offer for each of the components the following "benchmark" measures: (1) depreciation shortfall on a utilities fixed assets, (2) the constant dollar buying power of the earnings and dividends per share and (3) the coverage of fixed charges. Adverse trends in any of these measures could obviously impair the viability of the firm and cause the regulator to arbitrarily adjust the rate of return upward.

The three components of financial integrity can be more usefully examined together to demonstrate one of the most important issues in setting a fair rate of return. With unabated inflation over the past two decades the issue of capital maintenance has become more and more important. There are two conflicting views. The first is that financial capital should be maintained and the second is that physical capital should be maintained[9].

Maintenance of financial capital has as its objective to ensure that the suppliers of capital are "kept whole". In order for an investor to be "kept whole" he must receive a cash flow sufficient to repay the principle invested and to earn a fair return on the amount invested. In other words, the present value of the future cash flows (deprecation and rate of return) discounted at the cost of capital equals the value of the initial investment. Financial capital can be maintained using either the original or the current value of the investment. The maintenance of financial capital is discussed in more detail and illustrated in Appendix I.

Proponents of physical capital argue that for a firm to remain whole its assets must generate sufficient cash flow to replace the productive capacity of the enterprise. To operationalize this concept the value of the assets are adjusted each year to reflect their current value[10]. Using this value and the remaining expected life of the asset as a basis, a future cash flow stream can be identified which will allow for the asset to be replaced. As with financial capital maintenance, this future cash flow stream is a combination of both depreciation and rate of return. Since depreciation is based on the current value, suppliers of capital are no longer exposed to inflation risk[11] and the appropriate discount rate is the real rate of return. In summary, physical capital is maintained when the present value of the future cash flows discounted by the real cost of capital equals the current value of the asset in a particular year. The maintenance of physical capital is also illustrated in Appendix I.

From the foregoing it can be seen that financial and physical capital maintenance protect the integrity of the firm in different ways. Financial capital maintenance protects the investor while physical capital maintenance protects the company's productive capacity. From the examples in Appendix I it can be seen that one of the ways this difference manifests itself is in the treatment of inflation. Financial capital maintenance does not adjust for the costs (or benefits) of unexpected rates of inflation until the reinvestment decision is made. On the other hand physical capital maintenance incorporates the impacts of unexpected inflation on an on-going basis. This difference is the key to understanding the arguments for and against each of the capital maintenance rules. To illustrate these differences consider what happens when demand is perfectly inelastic and the actual rate of inflation exceeds the expected rate. When this occurs two questions arise: (1) Is it necessary to adjust the rate of return to keep the investor whole?, and (2) How are replacement assets to be financed? Proponents of financial capital maintenance argue in the first case that investors knew the risk existed at the time of the investment and demanded a rate of return sufficient to compensate them for that risk. Such an argument is consistent with cost of capital theory presented in the previous chapter. It should also be remembered that actual inflation could be less than expected yielding a windfall gain to equity investors.

With regards to reinvestment decisions proponents of financial capital consider it to be a separate capital budgeting decision. At the time of reinvestment, a decision to reinvest is made based on future expected earnings and inflation. Under the maintenance of physical capital approach, the reinvestment decision remains discretionary but the necessary funds are available for financing and no external funds are required. Thus, proponents of physical capital maintenance point out that this approach ensures the company can perpetuate itself. They also point out that, at the time of reinvestment, there is no large jump in the prices which have to be charged customers because the adjustments over time have kept pace with inflation.

The major objection to the use of the physical capital approach is that, when inflation exceeds expectations, it results in a "windfall" gain to investors in those situations where cost increases can be passed on to customers. In the case of the one hundred per cent equity financed company this occurs by virtue of the equity holder being able to retain both his real rate of return (see Appendix I) and the increase in the value the physical assets. The desired real rate of return is easily sustained by the ability of the investor to buy and sell his shares. In addition, the upward adjustment in asset values which occurs protects the investor from the inflation risk.

Now consider what happens when debt financing is introduced. From the perspective of maintaining financial capital the issuance of debt is not a problem. The investor remains whole simply by the periodic payment of interest and the repayment of principle at a specific time in the future. Maintenance of physical capital when the firm is partially financed by debt yields some interesting complications. Like equity, interest rates can theoretically be split between nominal and real rates of return. The inflation component, however, is restricted by contract to the expectations at the time the debt instrument was used. Consider again what happens if inflation is greater than expected. The expected cost of replacing the asset rises and prices are raised to account for this. Since the interest rates are fixed, the additional revenue generated accrues to equity holders..

These two concepts of capital maintenance demonstrate clearly the interrelationship between depreciation and rate of return (cost of capital). They are interrelated by their treatment of inflation and consequently must be consistent with each other if inflation is not to be double counted or omitted[12]. The impact of inflation on an asset's valuation may be captured by a change in the value of the asset or an increase in the required rate of return on the asset, not both. Consequently, the calculation of a return on investment using a nominal cost of capital rate on an inflation adjusted net asset base is obviously incorrect.

The choice of how inflation is treated is usually one of practical considerations. Subsequent discussion will show that asset valuation adjustments present some difficult problems in measurement the proper asset valuation and the real rate of return[13].

2.2.2. Comparable Rates of Return: This is the second legal test of fairness. This criteria requires that a regulated company be allowed a rate of return commensurate with that earned by companies having similar risk. Most often the rates of return calculated[14] will differ from the cost of capital estimated for the firm. This could be due to market imperfections which may, for instance, provide the unregulated company (or companies) used as a basis for comparison with some amount of monopoly profits. If this is the case, the comparable earnings standard, notwithstanding the computational difficulties, provides regulators with information to be used in resolving the problem of 'second best'.

2.2.3. Compensation For Risk: This is the third legal criteria. Most of the elements of risk, business risk and financial risk, are captured by market based cost of capital techniques. The market price for a security reflects the investors' required level of compensation for the risk inherent in that investment. However, the models used to measure risk, the CAPM especially, focus only on stock price variability and conclude regulated companies are less risky than, say, industrial companies. There are other elements of risk which may impact on a regulated company which are not an element of risk to a non-regulated industry. As examples, Christy and Christy[32,pp29] identify the following arguments which have been used to support contentions that utilities are riskier than the conventional measures of risk would indicate:

a) The higher debt ratios of utilities vis-a-vis industrials increases financial risk.[15]
b) Price regulation and regulatory lag create price level risk.
c) Exposure to consumerists, environmentalists, and public ownership agitation expose investors to a unique regulatory risk.
d) The fact that utility stocks are held primarily as income investments increases their vulnerability to rising interest rates.

In addition to these elements of risk, Canadian Railways have, on a number of occasions139], argued that there is a legislative risk. Here they are referring to changes in government policy and regulators which may affect the level of compensation they receive from subsidized services.

From the preceding discussion of the legal criteria used to guide the process of setting a fair rate of return it should be quite obvious that they are based on some sound economic rationale. The criteria, while not perfect or without controversy, do provide the regulator with sufficient leeway to balance the needs of investors and customers.

2.3. OTHER CRITERIA FOR RATE OF RETURN DETERMINATION

Efficiency is another area of concern which may cause the regulator to set a rate of return greater than the cost of capital. Kahn[79,pp53] argues that public utilities should be allowed returns markedly above the base cost of capital in order to provide them with both the financial means and the incentive to engage in risky innovation, both technological and commercial. The problems of actually doing this are described by Kahn[79,pp44] below:

> The micro economic model that calls for equating all prices to (marginal) costs and profits to the (marginal) cost of capital...is a static one. It tells us how to make the most satisfactory use of our limited resources with given tastes and given technology. But it does not necessarily tell us how to best promote economic progress. The provision of incentives and the wherewithal for dynamic improvements in efficiency and innovations in service may require allowing returns to exceed that level: this was the essence of Joseph A. Schumpeter's classed defence of monopoly. Thus, the rate of return must fulfill what we may term an institutional function: it somehow must provide the incentives to private management that competition and profit-maximization are supposed to provide in the non-regulated private economy generally.....There is as yet no scientific way even of defining the rate of return arrangements that would achieve this more complex definition of economic optimality, not to mention measuring them.

Unfortunately, there is not universal agreement that setting the rate of return above the cost of capital will yield an efficient choice between factors of production. An extensive study conducted by Averich and Johnson[1] demonstrated that setting the rate of return above the marginal cost of capital creates an incentive for firms to use more than the efficient amount of capital relative to other factors of production. As an alternative, it is argued that the necessary incentives can be created by allowing regulated company to earn excess returns in the short run. This can be accomplished through conscious use of regulatory lag. Regulatory lag provides a short run period in which utilities can earn unexpectedly high (or low) returns. At the end of the period the regulatory process acts in a manner analogous to the competitive forces which create long run equilibrium.[16]

The foregoing discussion outlined the various criteria which impact on the process of setting a fair rate of return. For the most part, the criteria adopted in the legal interpretations have a solid basis in economic, regulatory, and financial theory. However, given the current state of the theory, the implementation of these criteria requires that analysis be accompanied by sound judgment. The framework within which these criteria are currently employed is the rate base rate of return methodology. This is explored in the next section.

3. RATE BASE RATE OF RETURN METHODOLOGIES

In the previous chapter and again at the start of this chapter it was pointed out that both the cost of capital and return on investment[17] are dollar costs. So far they have been discussed in percentage terms only. The method almost universally used to convert the cost of capital rate to a dollar cost is the rate base rate of return formula. Very simply the cost of capital(K) can be expressed as product of the cost of capital rate(k) and some measure of the asset value(B).

$$K = kB \qquad (3\text{-}1)$$

The following discussion will examine the issues surrounding the selection of the appropriate combinations of asset base and rate of return measures. Two basic considerations, inflation and end use, govern the proper combination of the cost of capital rate and the asset base. It has already been demonstrated that inflation must be treated in a consistent manner. The second relevant consideration is the end use or purpose for which the cost of capital is being calculated. In most circumstances the cost of capital is being estimated to be used to guide future investment (or disinvestment) decisions or to define fair rates of return to be used in pricing decisions. There are also instances where measures of the cost of capital are required to compensate a firm for a service which it has provided.

In the foregoing discussion a number of controversial issues have been raised such as which cost of capital measure to use, whether book or market weights should be used to calculate the weighted average cost of capital, and whether the objective should be to maintain financial or physical capital. Given a capital maintenance rule, the manner in which each of these is resolved will affect the dollar value of cost of capital calculated but will not affect the proper combination of asset base and cost of capital rate. By making the following assumptions it is possible to illustrate the proper combinations of asset base and cost of capital:

a. The nominal and real costs of equity capital are known. Also the embedded nominal and real cost of debt capital are known.

b. The book weights for debt and equity represent the long term optimal capital structure for the firm and new funds will be raised in those proportions.

c. The regulator's goal is to maintain the financial integrity of the investors who have invested in the regulated enterprise.[18]

The impact of dropping these assumptions will be explored at the end of this section.

With these assumptions the various rate base rate of return formulas can be simplified into three groups depending on the measure of the asset base used. The three alternative asset base measures are

a. book value
b. market value (opportunity cost)
c. current value

By describing these as alternative measures it is implied that they are all different. This is almost always the case in practical applications but there are two important theoretical conditions which would cause them all to be equal. That is, in a state of long run equilibrium with perfect capital markets or after a long period of continuous regulation wherein the rate of return is set equal to the marginal cost of capital rate applied to the net book value. Under these conditions the market value of the firm would equal its book value and, if current value is defined as replacement value[19], would also be the same. The reason for this is that the market value and replacement values reflect the earning power of the assets in the economy and this has been restricted by competition to the marginal cost of capital. Some of the reasons, given by Myers[100,pp75-77], why these values rarely equate in the case of public utilities are:

a. Unanticipated changes in the external environment, such as a fire, surge in demand etc. may cause the utility not to earn a return equal to its cost of capital.

b. Regulatory lag.

c. Cost trends which deviate from the expected levels when the rate of return is set. For example, introduction of new technology.

d. Factors not under regulatory control. For example, ownership of unregulated subsidiaries.

e) The regulator, for reasons discussed earlier, sets the allowed rate of return above the cost of capital.

Later, when railways are discussed more specifically, it will be shown that additional factors such as excess capacity and obsolete technology are also major factors contributing to the deviation of the various measures of the asset base.

The rate base rate of return can use any of the three asset valuation measures to produce measure of the cost of capital. Each of these three measures will be presented below along with the reasons for using the nominal, real, or embedded costs of debt capital and the nominal or real cost of equity capital.

3.1 BOOK VALUE

The most widely used method for calculating the cost of capital to a firm is to multiply the book value of the assets by the weighted average cost of capital rate. Book values reflect the original purchase cost of the asset and are taken from the left hand (asset) side of the balance sheet. Quite often considerable effort is expended in public utility cases to ensure the base contains only used and useful assets. In an examination of public utility rate cases, Welch[153] identified many of the criteria used to evaluate an asset base measured at book value. Items which should be excluded from the rate base include:

a. duplicate and unused property
b. obsolete and inadequate property
c. property to be abandoned
d. abandoned and suspended property
e. real estate and building leaseholds; water rights
f. incomplete and contemplated construction
g. property used for non-utility purposes
h. property not owned
i. property donations
j. deposits and moneys advanced by customers.

There are many reasons, both practical and theoretical for using the historic rate base. Some of the more important ones are given below:[20]

a. It is administratively easy. The values of assets are recorded on the books of the company at the time of their purchase using generally accepted accounting principles.

b. Book values best capture investor expectations at the time of investment. The amount on the books represents the value which investors expect to be paid back. It was shown above that, at the time of investment, investors have expectations regarding the rate of inflation.

c. If the industry is growing fairly rapidly the differences between the current value and book value of the firm will not be great.

d. Provides a relatively stable basis over time.

e. Provides an audit trail for the regulators.

If book value is used to measure the value of the last asset purchased and multiplied by the weighted[21] market cost of capital rates for debt and equity, it will yield the marginal cost of capital. However, for reasons discussed above, the regulator is usually interested in the average cost of capital to the firm for all its assets. In this regard there are two approaches which are advocated. With the first approach the regulator uses a weighted average cost of capital based on the current market costs of debt and equity. The second, and more commonly used approach, is to compute a weighted average cost of capital using the embedded cost of debt and the market cost of equity. It is in the treatment of the cost of debt that the two differ.

The use of market rates of interest for the cost of debt is appealing on the grounds it better reflects the opportunity cost of the funds employed by the enterprise. However, such an approach, when used for pricing or compensation causes a serious practical problem. Debt is issued at a fixed rate based partially on investors' expectations about future inflation. If the cost of debt is varied over time with the market rates of interest, the benefits and/or costs accrue to the equity holders, not the bond holders. As a result, the maintenance of the bond holders' financial capital is neither enhanced or impaired.

Proponents of the use of the embedded interest rates argue that this approach reflects the actual financial cost of the capital supplied through debt and provides investors with the return necessary to protect the original value of their investment. The use of the embedded cost of debt rate does not deny the company access to future debt capital in the capital market[20,pp48] as the costs of new debt would be included in calculating the embedded rate. It can also be argued that the embedded debt rate is the proper rate to use when the cost of capital is being calculated for purposes of determining compensation for services provided.

While the two approaches differ in the treatment of debt, they do not on the treatment of equity. Both use the current nominal market rate. The reason lies in the nature of an equity investment. Unlike bond holders, equity investors cannot regain their initial investment by holding the security to its maturity. Moreover, the purchaser of a conventional bond enters into a rigid contract under which the borrower is expected to pay a specified rate of interest and to repay the original investment. But, as Nelson[105,pp20] points out:

> the common stockholder does not, and cannot, insulate himself from future change. He hopes, instead, to obtain maximum benefits from it, and is presumably prepared to assume risks of loss in return. Thus no commission can differentiate between the treatment of purchasers of the latest utility stock issue and the simultaneous treatment of stock already outstanding.
>
> Since common stock involves no hard and fast commitments, treatment of rate of return to influence yield on the book value of common stock can follow no hard and fast rules. Clearly no common stockholder is entitled to anything, come hell or high prices. But,

> just as clearly, an attempt to deprive the utility common stockholder of the increased yield per share in other industries which would tend to proceed directly from inflation, or indirectly and probably over a longer period from higher interest rates, could be self defeating because it might tend to raise the actual or ex poste return to capital by frightening away potential new investors.

With historic valuation the rate base rate of return yields an average total cost of capital. As was pointed out earlier; some economists will argue that prices based on such an average cost will result in incorrect pricing and consequently sub-optimal levels of output[79,pp113-114]. Since the idea of subsidy to a monopoly is abhorrent and the legal criteria for fair rate of return exist, the historic rate base valuation technique continues to be used almost universally by regulators[22].

3.2. MARKET VALUE

The asset valuation measure which is the most consistent with economic and financial theory is the market value of the firm's assets. In a competitive environment, with freedom of entry and exit, the market value of the firm's securities and the net book value of its assets will converge[87,pp106]. In other words the market value of the securities reflects the expected earning stream from the use of those assets which, in the state of equilibrium, is the opportunity cost of the assets in an alternative use.

Proponents of the use of market value as the appropriate asset base argue that investors are concerned with the current market value of the firm, not its book value. For instance the Canadian Transport Commission[28,Vol.2p33] argues that:

> In choosing among available financial assets, the individual investor is concerned with his expected yield (including risk assessment) relative to the current purchase (or selling) price for the asset. It is the current market value (reflecting expected future cash flows and their timing) of the financial instrument he has acquired (or continue to hold), and not his proportionate claim on the book value of the firm's report assets, that forms the base for his yield expectations.

It is also argued that the use of market values will lead to a better allocation of resources. This can be illustrated by considering the case where the regulator must give approval for the abandonment of a service. Under these conditions the salvage value (market value) of the assets employed will provide the decision maker with better information than book values.

While the market value has desirable qualities it does have some serious problems. The application of the market cost of financing to the estimated market value of the assets could result in the double counting of the inflation costs. It depends on the procedure used to develop the market costs of the assets whether or not the nominal rate of interest has to be lowered to eliminate this double counting. In some simple market valuation calculations the nominal rate must be lowered to the real rate of interest. However, in those cases where the market value is converted to a capital recover factor[23], the nominal rate of interest can be used. Between these two extremes the removal of the double counting requires some complex computations[85].

Probably the most perplexing difficulty with this approach is the measurement of the market value of the assets. Provided the firm has its own capital structure with securities traded on the open market it is usually easier to measure the market value of the firm using the right-hand side of the balance sheet. Measurements based on the left-hand side of balance sheet require either active markets for the firms assets or estimates of their expected future earning streams. Both of these latter measures are very difficult. Even valuation based on the right side of the balance sheet has some problems when the firm has deferred tax balances, donations and grants and short term liabilities.

As expected, the current market value of the assets is much more volatile from period to period than book value measures. This is not necessarily a problem if one accepts that the volatility is a reflection of the fact that most assets are risky. The impact of the volatility is to create gains or losses to equity holders. This in itself is not bad if this is what is desired by the regulator and expected by the investors.

Over and above these measurement and stability problems, there is always the danger that, in using the market value as a basis for determining the allowed rate of return, the result could be circular in its results. As Myers[100,pp74] states, "fair value is the end product of the process of rate making not the starting point". Carrying this argument further Myers[100,pp85] also points out that, "adopting stock market values as a rate base amounts to a commitment to confirm investors' expectations regardless of what they are based on." For these reasons, the market value of the assets should not be used in a regulated environment irrespective of the measurement problems mentioned above.

The market value approach is not used to any great extent by regulators when setting target rates of return or when determining fair levels of compensation. However, as mentioned it could be useful in some instances, such as decisions on the abandonment or discontinuance of a service[24].

3.3. CURRENT VALUE

Current value approaches to asset valuation can take a number of different forms. The definitions below define some of the more common approaches[20,pp25-27]

> a. Replacement Cost: The estimated current cost (or cost prevailing at a specific evaluation time) of a new unit of property which will maintain the same level of service or capacity of an existing unit or property. Under the replacement cost concept the new units of property can be different from the existing property units so long as they will provide a service that is consistent with that which was provided with the original existing property unit.
>
> b. Reproduction Cost: The estimated current cost of new units of property that are identical to the units of property now in existence. Some limits may be placed on a strict interpretation of this concept since the passage of time may preclude the reproduction of identical units.
>
> c. General Price Level Adjusted Cost (GPLAC): The estimated cost of replacing existing units of property

> which is derived by multiplying the original cost of all property taken together by a price index. A similar process wherein the original cost of each property item is multiplied by an appropriate cost index is referred to as "trended cost."
>
> d. Current Cost: Costs expressed in terms of dollars equivalent to the present purchasing power of a dollar.

The above definitions which, for convenience, shall be referred to as current value methods are in many ways related to the market value approach described above. However, they are different in one very important way. The various current value methods, with the possible exception of replacement costs, do not reflect the earning power of the assets. The emphasis is on estimating a value which reflects the impact of inflation on the worth of a firm's assets.

The current value methods are usually offered as proxies for the true economic value of a firm's assets. As such the arguments given above for use of a market value for proper asset valuation also apply in the case of the current value measures. While most economists would agree that market value is the proper measure, measurement and other problems often require that a proxy be used. Consequently the debate focuses on which is the better proxy, book value or current value.

Proponents of current value argue that, if prices are equal to marginal costs, prices in a competitive market will tend to cover current, not past, capital costs. However, as Kahn[79,pp109] points out, this is a statement of long run tendency only and deviation from it in periods of long-run inflation or deflation will result in the inefficient allocation of resources . In the case of protracted inflation original cost valuation will yield an asset base which is a blend of old and new values. Using this valuation of the asset base, it is argued, would yield prices which are too low resulting in waste.

Another argument in favour of current value methods arises where there are two or more regulated companies competing with each other[25]. When the original cost base is used in this situation, the customer's choice will not be determined by the respective marginal costs of the two companies, but rather by the vintage of the assets they employ. Taken one step further, it is argued that where there is a significant difference between reproduction cost to original cost ratios of regulated and non-regulated industries, a missallocation of resources could also occur.

Original cost rate base valuation also causes problems when prices are cyclical. Use of the original value will create perverse cycles by holding prices down when general price levels are rising and holding prices up when general price levels are declining. There are also some adverse macro economic consequences if the regulated entity is capital intensive. If the original cost valuation causes prices to be held down during periods of inflation, consumption is encouraged. The regulated entity must then expand to meet this demand which, in turn, contributes to the excess levels of aggregate demand.

In addition to the resource allocation arguments given above, three other reasons are often offered for use of a current value as opposed to an historic cost rate base[109]. These are:

a. To ensure the firm is able to raise funds for replacement of existing assets[26].
b. To maintain the real income of investors.
c. to preserve the credit standing of the firm.

Despite the theoretical and practical problems with these later three arguments which have been previously discussed, they are still often cited in regulatory proceedings.

With regards to the appropriate cost of capital rate to use with current value measures there are two schools of thought. Those who adhere to marginal cost pricing would argue that the marginal cost of capital stated in nominal terms is the appropriate rate. While this is a theoretically correct approach it is not used in practice. The reasons for this have already been discussed. Where the concept of maintaining financial capital is used as the basis, the real cost of capital is the appropriate rate. This avoids the problem of double counting inflation and the resulting windfall to existing shareholders.

There are many reasons why regulators are reluctant to abandon the use of the historic asset valuation. Some of the more important ones are summarized below:

a. There are significant measurement problems. Irrespective of which current value method is used the upward valuation of the asset base is surrounded by suspicion and controversy. The two methods which most closely match to the market value measure, replacement and reproduction costs are the most controversial and difficult to implement.

b. Where the regulator's objective is to maintain financial capital it does not matter which rate base is used. Numerous authors[27] have demonstrated that the historic base with the nominal cost of capital rate may not yield significantly different results from the replacement cost base with the real rate of return.

c. Switching from an historical cost base to a current value base retroactively would provide a firm with a windfall gain or loss.

d. It has not been demonstrated to regulators that investments made at current rates are impaired by the use of the historic asset values.

e. The regulators have not been convinced that a serious distortion is created by the lag of prices behind reproduction costs. Whether there is a problem depends on the size of the lag and the elasticity of the demand for the companies services. Just as important is the degree of the lag relative to other non-regulated industries.

f. From the point of view of the investor, any combination of asset base and cost of capital is fair so long as it was reasonably anticipated at the time of investment.

As Kahn[79,pp113] points out both these measurement schemes can be wrong from an economic perspective. He reminds the reader that:

> ...the proper economic standard is not current average total cost but either short- or long-run marginal costs. The entire concept of determining rates by incorporating some average necessary rate of return on total investment, however value, is a misleading one except in the circumstance that the industry operates under conditions of long-run constant costs.

3.4. IMPACT OF ASSUMPTIONS

At the start of this examination of the asset valuation issue three assumptions were made to simplify the discussion. The first of these stated that the nominal and real costs of equity capital were known as were the embedded nominal and real cost of debt capital. Relaxing this assumption does not alter the foregoing discussion except to create uncertainty regarding the accuracy of the estimates.

Altering the second assumption concerning the use of book weights does have some impact on the estimates. If marginal cost pricing is to be adhered to, then it is argued that the market value weights and costs for debt and equity should be used. However, applying a market value weighted cost of capital rate to the book value of total assets will result in wealth transfer between bondholders and stockholders. This transfer is caused by unexpected changes in interest rates or inflation. Should interest rates rise above the coupon rate of debt, the use of the market rate would benefit the equity holder in two ways. First the difference between the market and coupon rate would accrue to the equity holder. Second, the rising interest rates would drive down the value of the bonds increasing the weighting in favour of the higher cost equity capital. Thus, market weights should only be used with the market value of the firm and with current value measures if it can be assumed that these represent the earning power of the assets.

The third assumption states that regulators aim to maintain financial and not physical capital. If this is altered then the historic valuation is invalid when inflation does not conform to expectations. Where inflation exceeds expectations, the use of book values with a cost of capital which uses the embedded cost of debt will not yield sufficient cash flow to replace the asset.

From the above it can be seen that the key element, particularly in the latter two assumptions, is the manner in which the cost of debt is treated. The proper treatment of the cost of debt depends on whether the regulator is interested in the marginal or average total cost of capital and whether he is concerned with the maintenance of financial and physical capital. There is no definitive answer. The regulator must consider the end use for which the cost estimate is being made. Each of the common end uses are presented on Table III-1 along with the generally used asset valuation, weighting system, cost of debt and cost of equity.

4. SUMMARY

This chapter examined regulatory theory in so far as it impacts on the process of setting a fair rate of return. It was shown that, what constitutes "fair" is more than an economic question. Social, political, and practical considerations have very important roles to play. Even the basic building block in the determination of the fair rate of return, the cost of capital, requires judgment on the part of the regulator. For these reasons the fair rate of return has to be viewed as a zone of reasonableness.

From the discussion in this chapter it is clear there are no hard and fast rules to guide the regulator in the task of setting the fair rate of return. Baumol[3,pp188] summarizes the basic problem encountered:

Table III-1

End Uses and Rate Base Rate of Return Components

End Use	Asset Base	Weights	Cost of Debt	Cost of Equity
Pricing	Historic	embedded	embedded	market
Compensation for Imposed Public Duties	Historic	embedded	embedded	market
Abandonment of a Service	Market (salvage)	embedded	embedded	market
Addition of a Service or Entry	Market	embedded	market	market

> Economists complain, with some reason, that the criteria employed by regulatory agencies find little justification in economic analysis. Yet a regulatory commission can reply with at least equal justice that the economic literature offers little help to those who must decide on policy in an imperfect world.

If perfect competition were prevalent in the economy the task of setting the fair rate of return would be considerably easier. Price would be set equal to marginal cost and the regulator would be reasonably assured of proper resource allocation. However, in today's economy, the problem is one of making judgments concerning second best solutions. In his description of the regulatory practice Bonbright[12,pp285] demonstrates the judgmental nature of fair rate of return determination.

> Even those public service commissions and financial experts who derive their conclusions as to a fair rate of return in large measure from their estimate of "cost of capital" seldom completely identify their conclusions with their estimates. More often than not, the estimated cost is offered as a minimum standard of adequacy, subject to "judgment made" additional allowance for possible error, for real but not measurable items of cost, for "regulatory" and even perhaps as a reward for efficient operation.

The discussion in the chapter identified a number of economic and legal considerations which cause the fair rate of return to deviate from the economic optimum condition. From the economic perspective having marginal cost less than average cost and market imperfections are the two major factors which necessitate some adjustment. Years of jurisprudence have contributed a number of constraints which must be taken into consideration by regulators. These economic and legal considerations have been restated as the following set of criteria which can be used to evaluate the funds flow model.

a. The regulator should minimize the misallocation of resources by eliminating monopoly profits and minimizing the distortions in demand patters.

b. The rate of return should not result in the confiscation of the firm's capital. In other words, the rate of return should not be below the average cost of capital unless there is a provision for a general subsidy to the industry.

c. The rate of return should not discourage operating efficiency. It is up to the regulator to determine if the rate of return can be used to promote efficiency.

d. The rate of return should allow sufficient earnings for the company to continue to attract capital to expand but should not encourage uneconomic investment as a means of expanding the asset base.

e. The rate of return should be sufficient to maintain the financial integrity of the firm. In other words, the allowed rate of return should ensure the maintenance of the company's financial capital.

f. The rate of return should provide a return commensurate with that earned by other enterprises of corresponding risk.

g. The rate of return should be sufficient to compensate the company's investors for the risk assumed.

In the latter part of this chapter attention was focused on the rate base-rate of return formula. This formula provides the mechanism for converting the rate of return, expressed as percentage into a dollar amount. It is critical to keep in mind that it is their dollar amount which is of interest to the investor, not the percentage. Too often, in the regulatory exercise of setting the fair rate of return the greatest amount of effort is directed at the rate of return and not the rate base. The discussion in this chapter demonstrates the critical importance of the proper selection of the asset base when the rate base-rate of return formula is used. In addition, it appears that the decision of most regulators to use the net book value is really a choice of the option with the least measurement problems.

The discussion of the rate base-rate of return also stressed the importance of properly matching the rate of return with the asset base measure. Care must be exercised not to double count inflation costs when the replacement and market value measures are used. Also, depending on the "end use" for which the rate of return is being estimated, care must be exercised in using the market or embedded cost of debt.

While the funds flow model differs significantly from the rate base rate of return formula, there are a few criteria which need to be adhered to which arise out of the discussion of the rate base rate of return formula.

a. The measurement of the rate of return should be consistent with the asset base used.

b. The treatment of inflation must be consistent with the asset base used.

c. The use of embedded or market costs of debt should be consistent with the "end-use" for which the estimate is being computed.

d. The measurement of the asset base should be consistent with the measurement of the rate of return. If market based techniques are used to measure the rate of return, the proper asset base is the market value of the assets.

The list of criteria presented here is not exhaustive, however, it does capture the essential elements of rate of return theory which can be used to evaluate the funds flow model. Some of the criteria are contradictory and others are very difficult to adhere to. Even the rate base rate of return formula has been shown to have serious faults. Thus, in evaluating the funds flow model, it is important to determine how well it meets these criteria, not whether it meets all the criteria.

ENDNOTES

1. The Statutory rates for grain are a significant exception. However steps have been recently taken to correct the problem.

2. Natural monopolies are characterized by a declining average (marginal) cost function.

3. It will be shown in Chapter IV that legislation governing Canada's national railways defines all three of these.

4. The rate base refers to the asset base mentioned previously. It is used to convert the cost of capital rate to a dollar cost.

5. For example, encouraging equipment suppliers to raise prices.

6. These objectives are based primarily on jurisprudence dating back to the U.S. Supreme Court decision on the Bluefield[7] and Hope[48] cases.

7. Financial integrity is usually defined as the companies credit rating.

8. In some cases the regulator allows the full asset value but adjusts the rate of return downward.

9. These terms are taken from the current debate in the accounting profession over current value accounting techniques. The nature of the accounting debate is captured in a paper by R.R. Sterling[145].

10. The current value concept has to be used as opposed to replacement costs to avoid circularity. The Supreme Court decision in the Hope case argued correctly that the actions of the regulator determine the market value of the firm and consequently its assets. Since the replacement cost concept uses the market value of the assets it would be dangerous to use this approach if therew was not an active market for the firm's assets. This should not imply that there are not problems with the current value concept.

11. This assumes, of course, that the inflation risk can be passed on to customers through higher prices.

12. Methods of accelerated depreciation are variations of depreciation on the original cost of the asset base and only serve to adjust the rate at which the original capital cost is recovered.

13. This is especially true during periods of high inflation and general uncertainty such as existed in the late 1970's and early 1980's.

14. The second chapter examined both accounting and market based methods for making these estimates.

15. Beta can capture this affect.

16. Studies by Bailey and Coleman[2] and Baumol and Klevorick[4] showed that conscious use of the lag could have the desired effect of obtaining minimum cost and maximum output.

17. For purposes of this part of the discussion assume the rate of return has been equated to the cost of capital.

18. As most regulatory institutions use the maintenance of financial capital, it will be used here. The reader should be reminded that, at the margin, the goals of maintaining financial and physical capital can not be differentiated.

19. Any method using price indexes will not yield this situation because the new values are mechanically produced each year.

20. The reasons are a compilation of those given by Kahn[79,pp33-41 and pp112-114], Myers[100,pp84-87] and Philips[109].

21. Ideally the computation of the weighted average cost of capital would use market weights for debt and equity.

22. The major deviation from this is the use of a trended original cost rate base mow being examined by such bodies as the National Energy Board.

23. Capital recovery factor is the annuity whose present value is equal to the market value of the asset using the current nominal rate of interest.

24. It is used in branch line abandonment and passenger service discontinuance decisions by the Canadian Transport Commission.

25. Canada's two national railroads compete for some regulated traffic.

26. The reader should recognize this as the maintenance of physical capital rule.

27. Three good references are S.C. Myers[100,pp85-87], Governments of the Prairies[111,Vol.1,pp16-25] and A.E. Kahn[79,pp112-113].

CHAPTER IV

CANADIAN RAILWAYS:

REGULATION AND RATE OF RETURN DETERMINATION

Canada has two trans-continental railway companies. These two companies, CN Rail and CP Rail, are regulated by the Canadian Transport Commission under authority given them by the National Transportation Act[156], the Transport Act[158], and the Railway Act[157]. The manner and degree of regulation imposed on the railways has always been a contentious issue. As a result, the regulation of the railways has been subject to continuous review and changes over the years.

Compared to previous regimes the current regulatory system can be described as one with considerable commercial freedom in so far as rate setting is concerned. Some rate making constraints are contained in the legislation but their purpose is primarily to set acceptable guidelines for the railways in making their pricing decisions. Other aspects of railway activity such as entry and exit, safety, common carrier obligations[1], tariff publication, and the interface with other railways, are controlled by various parts of the legislation. The focus in this chapter is on those aspects of existing regulation which require an estimate of the rate of return as an input to the regulatory process.

The purpose of this chapter is three-fold. First it will identify the regulatory provisions which require an estimate of the rate of return as an input. This discussion will contain an historical background so that the current regulatory system can be seen in perspective and so that the reader can appreciate how the issues which dominate the current rate of return debate arose. The second part of this chapter will describe in some detail the procedures which are currently used in measuring the railways' cost of capital. Then, based on the information presented in Chapters Two and Three, the current procedures will be critiqued. At the conclusion of this chapter some observations will be made concerning the nature of the technical and practical problems with the current methodology.

1. HISTORICAL BACKGROUND

1.1. PRIOR TO 1959

Starting in the mid 1800's railway technology invaded North America. By 1885 a railway network spread across Canada linking remote areas to metropolitan centers. The expansion of rail system radically affected the economic, social and political structures of Canada. One of the most significant impacts of railways arose out of realization that the railways not only enlarged markets and producing areas but also could be used as an instrument favouring the concentration of economic activity and control. As it became more obvious that the economic benefits of railroads were not necessarily being shared equally by all users, the over-riding government laissez-faire philosophy began to be questioned.

One of the major policy problems caused by the railways was general public distrust of the railways' pricing on the basis of what the traffic would bear[2]. While discriminatory pricing was accepted as a basis for setting a rate structure, the government did retain considerable control over railway rates. Most of the historic events pertinent to this study occurred during the existence of the Board of Transport Commissioners (1938-67)[3]. Among the powers given to the Board was the power to regulate rates, fares, demurrage, and other charges made by the railway companies subject to its jurisdiction[4].

During the Boards existence there were a steady stream of Royal Commissions on Transportation. However, it was not until the post World War Two period that freight rate and rate of return issues became a key issue in a Royal Commission. Following the war, railway revenues fell sharply as highway carriers were able to capture more and more inter-city freight business. Faced with declining revenues the railway applied to the Board of Transport Commissioners for their first general increase in rates since 1920. The Board agreed and granted a general 21% increase in 1948[5]. In making its award, the Board used as a criterion the financial requirements of the Canadian Pacific Railway[6]. The award was based on a calculation of net operating revenues (after a provision for operating expenses and income taxes) necessary to accommodate fixed charges and dividends plus some additions and betterments to railway property[99,pp6].

During the 21 per cent case, the railways not being satisfied with the requirements formula, proposed the use of rate base-rate of return formula. The railways argued that the requirements formula greatly understated their revenue needs and that a rate base-rate of return method should be used. Evidence presented by the Railways in support of their position purported to show that even if they were granted the full increase requested (30 per cent), the rate of return on investment would only have been 3 per cent as compared to the 5 1/2 per cent considered desirable for Class 1 railroads in the United States at that time. While the Provinces, who were opposing the railways' requested rate increase, acknowledged the rate of return on the amount invested had some validity as a test by which the reasonableness of the rates may be judged, they argued that it should not be used because the investment base was overstated. The Board[11,pp24] ruled as follows:

> We might appropriately have some regard to the rate of return on the amount invested by the railways in railway property used in transportation services, as a test by which the reasonableness of the rates may be judged. One difficulty, however, is ascertaining the value of the railway properties so used in transportation services.

In the three year period following the 21 per cent case a complicated series of applications for rate increases, reviews, and appeals ensued. Taken together, these cases represent the turning point away from the requirements formula to the rate base-rate of return. In the course of these proceedings the basic issues which continued to beleaguer regulators were first introduced into railway rate of return determinations. The issues addressed during these proceedings focused primarily on the valuation of the asset base and secondarily on the measurement of the cost of capital[7].

Widespread dissatisfaction among shippers, especially those in the

West and the Maritimes, with the Board's 21 per cent increase led to the appointment of the Turgeon Royal Commission in 1948. The Commission was instructed, as part of its terms of reference, to review existing rate levels. Since the work of the Turgeon Royal Commission overlapped with the chaotic period following the 21 per cent case, it faced many of the same issues. In its report, released in 1951, the Commission [22,pp151] like the Board, rejected the rate base-rate of return procedure proposed by Canadian Pacific.

> The task of the Board in fixing, determining and enforcing just and reasonable rates, involves a duty to both the railways and the public; the Board must therefore be in a position that will enable it to determine, in so far as possible, the balance which will bring about this desired end. But since economic conditions may be such that different considerations exist under one state of affairs than under another it is not proper to lay down the priority which should be given to the principles which should guide the Board. The Canadian Pacific by its proposed amendment (for a rate base and a fair return) asks that priority be given to the principle of a fair return on investment; yet experience has shown that such a factor may not be the guiding factor; it may be one which in times of economic depression must give way to other considerations.

One of the major reasons given by the Board for not accepting the rate base-rate of return was offered by Dr. Bonbright who appeared as a witness during a 1952 rate case. He argued that the rate base rate of return method was designed for gas, electrical and telephone companies and was impractical for railways. The major reason offered was that the non-rail regulated utilities were, by and large, dedicated to producing a single commodity or service. Railways, in contrast offer a heterogeneous range of services both within the rail enterprise and the corporate entity[99,pp138]. In opting to retain the "requirements" method the Board[11,pp55-57] stated the following:

> The fundamental nature and nation-wide expanse of the railway enterprise in Canada as presently constituted do not lend themselves to an automatic translation of railway costs into rates-both freight and other rates-based on any preconceived return.
>
> ....the board, bearing in mind that we are living in times when rapid changes in conditions are liable to occur, wishes to leave itself free to adopt in whole or in part any existing or proposed formulae or any modification or combination of such formulae for such purposes and to such extent as it may consider appropriate under the circumstances and/or employ any other criterion of justness or reasonableness in fixing the general or any specific level of rates which it may be deemed warranted.

1.2. THE MACPHERSON ROYAL COMMISSION

In 1959 the railways applied for a further 12 percent rate increase. The situation had become untenable and the newly elected Diefenbaker Government appointed a Royal Commission under the chairmanship of M.A. MacPherson[8].

The recommendations of the MacPherson Royal Commission submitted in 1962 formed the basis of the National Transportation Act (NTA) passed in 1967[156]. The NTA[9] contained major changes in railway regulation and transportation policy. Since the NTA marked the end of the general rate increases and the use of the requirements formula, it is useful to reflect upon the state of rate of return debate at that time.

Despite a concerted effort by the railways, the rate base rate of return did not attain regulatory acceptance. The Board consistently argued that it needed the flexibility offered by the requirements formula. However, they did start to give the method some consideration after 1954 when a determination was made as to the amount of the investment in railway property. Even then there was considerable distrust in this determination which was never ameliorated. It is interesting to note that in all the debate over the rate base and rate base-rate of return procedure, there was very little discussion of the cost of capital or rate of return. This changed almost completely with the passage of the National Transportation Act.

In the view of some observers[44,pp214-222] the appointment of the MacPherson Royal Commission was an act of desperation. The government was caught between railway demands to be allowed to earn revenues sufficient to cover rising costs and regional demands to correct freight rate inequities[10]. Darling[44,pp219] ably describes the situation as one wherein the long dominant regulatory ideology was bankrupt. The Commission realized this and in its recommendations shifted the emphasis to competition as the dominant ideology.

The Commission made three basic policy recommendations [21,Volume I]:

a. The railways should be given the freedom to set rates subject only to minimum and maximum limits.

b. The railways should be allowed to rationalize their asset base through abandoning redundant branch lines and non-viable passenger services.

c. Where the railways are required to maintain service in the public interest, they should be compensated for the losses[11].

With these recommendations came a number of other related changes. No longer did the regulatory agency, now the Canadian Transport Commission, have to approve general rate increases. As a result, the requirements formula was no longer needed. Instead, the recommendations for minimum and maximum controls as well as public compensation to the railways for maintaining uneconomic branch lines and passenger services required that the cost of individual movements and services be estimated. To this end, the Commission concluded that capital costs, to the extent assets could be identified with individual movements or services, should be included as an element of cost.

The issues raised before the MacPherson Royal Commission pertaining to capital costs and the proposed resolution of these, forms the basis for the railway costing system used today. As discussed in Chapter III, capital costs have two components, depreciation and cost of capital. However, it was the two elements of cost of capital, the asset base and the cost of capital rate, which attracted the greatest amount of attention. It would appear that the matter of depreciation, which had been a major issue on prior rate cases and in the Turgeon Royal Commission, was, to a large extent, resolved by the implementation of Uniform Classification of accounts in 1955 and by the Board's decision to use straight-line[12] depreciation[99,pp145-146].

By the time of the MacPherson Commission, rail and non-rail assets have been segregated and the net investment in rail property was becoming more accepted as a basis for determining the financial requirements of the railways[13]. However, distrust of the net book value as a measure of the asset base did not abate. The major concern here was that the investment base was inflated to the extent that it included redundant and uneconomic assets attributed to branch line and passenger operations. The Commission concluded that the abandonment of these services over time, as they recommended, would resolve this problem.

It was during the MacPherson hearings that the debate over the cost of capital rate in a modern context first emerged as a conceptual subject. Prior to the MacPherson Commission the financial requirements of the "yardstick" railway (Canadian Pacific) were determined as the cumulative sum of fixed charges, surplus[14] and dividends of four per cent on preferred shares, and five per cent on ordinary shares of the company apportioned to the railway. The railways argued that this requirements formula, lagged behind the market cost of capital. As a result, the increased rate levels authorized by the Board produced net earnings for Canadian Pacific which continually failed to achieve the permissive level allowed by the Board[15]. Moreover, Canadian Pacific contended that the return to the rail investment which had been realized under the requirements formula did not represent the cost of capital but the cumulative effect of disabilities imposed on the company[16].

During the Commission's hearing a special costing study was undertaken by D.H. Hay[66]. One of the conclusions of this study was that the current cost of money[17] should be treated as a cost just as wages and materials. Although Hay's study focused on grain, the

Commission embraced the treatment of cost of money as being appropriate in the calculation of the costs of uneconomic services and the costs for purposes of minimum and maximum rate regulation. In addition, the Commission concluded that the cost of capital should be at the same rate for costing all services and traffic movements.11,Vol.3,pp326].

The Commission's recommendations concerning the decision to discontinue the use of the requirements formula in favour of the rate base rate of return was not due solely to theoretical deficiencies in the requirements formula. It was as much a matter of necessity. While the requirements formula would determine the capital costs for the railway as a whole, there was no acceptable basis for allocating the costs to specific services. On the other hand, with the rate base rate of return it is possible to use direct assignments[18] or regression analysis to estimate the value of the assets attributable to a particular movement.

In addition to the practical problems associated with the requirements formula, the MacPherson Commission was faced with considerable evidence of conceptual and theoretical shortcomings inherent in this approach. Purdy[114,pp212] summarizes the major shortcomings of the requirements formula which confronted the MacPherson Royal Commission.

> Fault develops out of the fact that it is basically determined by the captilization of the corporation in the form of its liabilities in debt, preferred and common stock, instead of being determined by the value of the capital resources dedicated to the service. In

> competitive industry, an economist finds in the earnings of the assets of a firm or industry, the device determining whether more or less resources should be and would be applied to a particular field. There is an opportunity cost for dedication of the assets to a particular use, and their earning power, under conditions of perfect competition, will bring on an equilibrium situation in which is found an ideal allocation of resources.
>
> The Requirement formula does not apply to the capital resources dedicated to the railway use but rests on the superficiality of the capitalization structure of the corporation.

Purdy[114,pp212-213] went on to point out that prior to the MacPherson Commission the requirements formula was yielding widely different results depending on debt issuance or retirement or asset base expansion or contraction. Referring to what became known as the "Rate Base-Rate of Return Application," Purdy brought this conceptual fault into the realm of specific detail. He pointed out that in the "Twenty-one Per Cent Judgement," decided early in 1948, the Earning Requirement was based on the capital structure of the CPR in 1947. This set the Requirement for the CPR at $54,545,000. However, debt retirement in 1954 reduced fixed charges, and the final allowance fell to $52,332,000. The first figure amounted to 5 1/2 per cent of the net investment of the CPR; the second to approximately 5 1/4 per cent.

Purdy pointed out that by 1951 railway property had grown from 997 million as of 1 January 1947 to $1,099 million in 1951. The Requirement now provided a return of 4.18 per cent on net investment in railway properties.

Year by year, this same phenomenon continued as the railway reduced its fixed charges and steadily increased its investment in rail properties without public financing. By January 1953, the permissible return to the CPR stood at 3.95 per cent of its net rail investment.

These examples clearly illustrate the conceptual problems with the requirements formula. Left unchecked it could provide a temptation for corporate management to adopt unsound financing policies by deliberately increasing debt obligations. Yet, the railways did not do so. The reason probably lies in existence of other economic forces which made it imprudent to raise more debt in order to increase revenue requirements[19]. Even though the railways were not able to earn the level of required revenue set by the Board let alone the level of return which was being asked for based on the rate base rate of return formula[42,pp69]. The railways, particularly the Canadian Pacific Railway,continued to press for the rate base rate of return formula. One reason for this, all be it speculative, is that the use of the rate base rate of return formula would yield a larger general increase which, when applied to the class rate structure[20], would yield higher rates on the low value bulk commodities not susceptible to truck competition. This could be accomplished without losing additional high rate traffic. Through the use of agreed charges[21] the railways could set rates on truck competitive traffic.

Additional pressure to discontinue the use of the requirements formula arose out of the fact that most other regulatory jurisdictions by this time were using the rate base rate of return formula. In fact, the Interstate Commerce Commission in the United States had been using it since 1920. It is interesting to note that during the period when the Interstate Commerce Commission was adjusting rate levels based on the rate base rate of return formula there was only one year (1925) where the railways reported net earnings near the allowed level[114,pp222]. The explanation offered for this situation was excess capacity in the United States rail network caused by both over building during the early states of railway construction and by the loss of traffic to the highway and water mode.

Noting that there were similar problems in Canada with excess capacity the MacPherson Commission believed their recommendations to allow the railways to rationalize their services and price competitively with trucks would alleviate this problem.

In summary, the recommendations of the MacPherson Royal Commission resulted in major restructuring of railway regulation in Canada. From the perspective of this paper the two most important changes were to recognize the cost of capital as a legitimate railway cost and to end the use of the requirements formula in favour of the rate base rate of return formula. However, it is important to reflect on two important points. First, the requirements formula was dropped primarily for reasons of necessity and second, the adoption of the rate base rate of return was tied to the Commission's recommendations for rationalization of the asset base.

1.3. THE NATIONAL TRANSPORTATION ACT OF 1967

Even though the first volume of the MacPherson Royal Commission on Transportation was tabled in the House of Commons in April of 1961, it was not until January of 1967 that the National Transportation Act was passed[22].When it was finally passed, the National Transportation Act brought into law most of the recommendations of the MacPherson Commission. The notable exception was the proposed subsidy for export grain moving at Statutory rates (Crow's Nest Rates). As a result, the Crow's Nest issue was "put on the back burner, only to boil over again ten years later"[44,pp227]. In general, the Act substantially deregulated the railways. While Section 3 of the Act contains a lengthy statement of policy[56], the best description of the basic thrust of the Act was offered by J.W. Pickersgill[23][quoted in 67,pp77], the first President of the Canadian Transport Commission[24] (CTC or the Commission).

> Competition between the modes is the essential ingredient of the national transportation policy....The major regulatory responsibility is to prevent unduly high rates in conditions of monopoly, or in conditions of competition, unprofitable rates that many throw an unfair burden on other traffic or undermine a more efficient mode...We have attempted in the National Transportation Act to bring our whole approach to transport development in Canada up to date: to regulate when necessary but only when necessary. Otherwise the interplay of competition forces will fashion the variety and the level of the rate of the competing modes.

The regulatory provisions, contained in the Act, of interest in this paper focus on setting acceptable parameters for freight rates and for compensation for specific services deemed to be required in the public interest. Each of these are presented below along with a short discussion on the role the cost of capital plays.

1.3.1. Definition of Costs: Underlying each of the regulatory provisions to be discussed subsequently is a definition of costs. This is contained in Section 329 of the Railway Act[157,pp6489] and states that in computing the costs for purposes of the Act there shall be included an allowance on a periodic basis:

a) for depreciation, and
b) in respect of the cost of money expended, whether or not the expenditure was made out of borrowed money.

1.3.2. Branch Line Abandonment: Following the recommendations of the MacPherson Commission, the Act contained provisions for the railways to abandon uneconomic branch lines. Sections 252 to 255 of the Railway Act[157,pp6423-6430] contain the criteria which the CTC must follow in its determination of whether or not the line should be retained. One of the most important criteria is that the line must have incurred an "actual loss" in one or more of the three previous years including the last year.[25] "Actual loss" is defined as[157,6423]:

> 'actual loss', in relation to any branch line means the excess of
> a) the costs incurred by the company in any financial year thereof in the operation of the line and in the movement of traffic originating or terminating on the line, over
> b) the revenues of the company of the company for that year from the operation of the line and from the movement of traffic originating or terminating on the line;

1.3.3. Branch Line Subsidies: Those branch lines on which service is ordered continued in the public interest or are protected from abandonment[26] are eligible for a subsidy under Section 258 equal to the "actual loss".

1.3.4. Passenger Service Discontinuance: During the MacPherson Commission some rail passenger services were found to be uneconomic and a burden on the railways. Therefore, like branch lines, the Act contained a mechanism whereby the railways could apply to discontinue rail passenger routes. The evaluation criteria for rail passenger discontinuance also required the railways to demonstrate that there was an "actual loss" for a specific service. If the service was found by the CTC to be necessary in the public interest, it was then eligible for a subsidy.

1.3.5. Passenger Services Subsidies: Rail passenger subsidies under the Act are calculated for those services retained in the public interest. Almost all of the services retained were turned over to Via Rail Canada to operate. The procedure for costing these services was not altered.

1.3.6. Rates on Less than Carload Traffic: Section 264 gives the CTC power to adjust rates on less than carload shipments (under 5000 lbs) where the shipper has not alternative, effective and competitive service by a common carrier other than rail carrier[27].

1.3.7. 'At and East' Grain Rates: To encourage the use of eastern ports for the export of grain and flour, the rates from the inland terminals along Georgian Bay and Lake Huron to ports at or east of Montreal were frozen at the level charged on November 30, 1960. The CTC determines a compensatory rate and a subsidy is paid to the railway equal to the difference between the CTC determined rate level and the November 1960 level.

1.3.8. Minimum Rate Regulation: When the MacPherson Commission recommended the railways be given the freedom to set rates, it was done under two conditions. One of these was the railways not be allowed to set rates below the variable cost of the movement. Recognizing that pricing below variable costs is ruinous to the railway and to do so would be imprudent of management, the Commission believed such a regulation was necessary to reduce uncertainty in the trucking industry[21,vol II,pp66].

With respect to all rate making sections of the Act[157,pp6451] the following constraint is placed on the cost of capital rate to be used for CN Rail:

> (3)In determining for the purposes of this section and Section 277 the variable cost of any movement of traffic, the Commission shall...
> b)compute the cost of capital in all cases by using the costs of capital approved by the Commission as proper for the Canadian Pacific Railway Company.

Thus the concept of the "yard stick" railway was continued from the previous regulatory regime.

1.3.9. Maximum Rate Regulation: The second condition under which the railways were to be given rate setting freedom was that rates should not exceed a maximum. The MacPherson Commission believed that there should be a maximum placed on rates to "limit the impact of railway monopoly on shippers"[21,vol.II,pp98]. In addition, they argued that the maximum should be based on the variable costs of the movement and should provide incentives for heavier car loadings to both the shipper and the carrier. What emerged was a relatively complicated formula[28]. In practice, the formula currently used does not provide the cieling on rates it was intended to.

1.3.10. Section 23 of the National Transportation Act:[29] The MacPherson Royal Commission was satisfied that minimum and maximum rate regulation would be sufficient to create a desirable pricing environment. However, during the period that the legislation was under consideration it was decided to supplement these regulations. The added provision to the NTA[156] permitted an appeal of a rate on the grounds it is prejudicial to the public interest.

> (3)In conducting an investigation under this section, the Commission shall have regard to all considerations that appear to it to be relevant, including, without limiting the generality of the foregoing,
> a)whether the tolls or conditions specified for the carriage of traffic under the rate so established are such as to create
> i)an unfair disadvantage beyond any disadvantage that may be deemed to be inherent in the location of volume of the traffic, the scale of operation connected there with or the type of traffic or service involved, or
> ii)an undue obstacle to the interchange of commodities between points in Canada or an unreasonable discouragement to the development of primary or secondary industries or to export trade in or from any

> region of Canada or to the movement of commodities through Canadian ports.

Where the CTC finds the rate to be prejudicial it may, having regard to the minimum rate rule, order that the rate be adjusted.

Given the broad nature of this section it is not surprising it is used more often than the maximum rate section of the Railway Act[30]. One of the key elements in most of the Section 23 cases is the cost to the railways for the movement under examination[67,pp237-277]. In these cases, the CTC adheres to the same costing rules and procedures as these do for minimums and maximum regulations, even though they are not required to by law.

1.3.11. Costing Regulations: Section 330 of the Railway Act[157,pp6490] requires the CTC to prescribe costing regulations.This section gives the CTC the power to determine the manner by which costs are to be calculated for each of the end uses described above. While the legislation instructs the CTC to include the cost of capital and deprecation as costs, it does not specify how. There is no direct mention of the rate base-rate of return formula other than the instruction to "have regard to the principles of costing adopted by the Royal Commission on Transportation"[157,pp6490].

1.4. COST ORDER R-6313[29]

As required by the new legislation, the CTC undertook to establish costing regulations. What ensued was a two year long process of technical meetings and hearings covering all aspects of railway costs. The end result was Order R-6313 which, except for a few modifications to be presented later, still governs railway costing procedures in matters concerning the Railway Act.

The legislation cited above instructs the CTC to include an allowance for depreciation and cost of capital. In interpreting its instructions the CTC[29,pp333] made the following observation:

> The words in section 329(1), " such allowance on a periodic basis for deprecation and cost of money...as to the Commission seems reasonable in the circumstances", means that the railways have a statutory right to an allowance and that the Committee (Commission) has a duty to fix a reasonable amount in respect of that allowance. However, we are satisfied that in our discretion, so limited, we may allow deprecation or cost of capital on different bases, or at different rates, for different purposes of the Railway Act.

In making the allowance for depreciation and cost of capital, the Commission treated these costs the same as all other costs in that they allocated only the variable portion of the element to any service or traffic movement. The CTC accepted the following definition of variable costs which was offered by Dr. G. Borts[29,pp336] during the course of the hearings:

> Variable cost may be defined as the long-run marginal cost of output, being the cost of producing a permanent and quantitatively small change in the traffic flow of output, when all resource cost inputs are optimally adjusted to change.

To allocate the cost of capital and deprecation the procedures used in the grain costing study in the MacPherson Report[66] were adopted. The procedure involves the three general steps which follow[20,pp16-17]

a. The gross investment in similar property accounts is related to the appropriate service units (e.g. gross ton miles, train miles etc.) to develop gross investment coefficients. Direct analysis[31], simple and multiple regression are used to calculate the coefficients.

b. The gross investment coefficients are multiplied by the ratio of net investment (gross investment less accumulated depreciation) to gross investment to obtain net investment coefficients related to service units).

c. The coefficients from step b. are multiplied by the approved and appropriate[32] cost of capital rate to yield the variable portion of the capital funds cost identifiable with the specified service units.

This procedure is a rate base rate of return formula with one major difference from the formula used by the public utility regulators. The rate base used is not the total net investment but only the variable portion thereof.

There is one exception to this procedure which occurs where specific assets can be identified as being totally related to an individual service. In these cases the value of the identified asset or assets is determined and multiplied by the cost of capital rate. Such assets are most often found in branch line costing where the investment in the branch line can be said to be 100 per cent variable with the service and in passenger service costing where assets like station buildings are found.

The procedure for developing the variable investment described above can only be performed for Canadian Pacific. Canadian National does not have adequate road property accounts or accurate depreciation reserves to conduct the same analysis. Therefore, the Commission ordered Canadian National to use Canadian Pacific's gross investment coefficients and net to gross investment ratios until such time as they are able to develop their own data base[33].

As it had in the past, the valuation of the asset base was the major impediment to using the rate base-rate of return formula. The provincial governments argued that the rate base was inflated and therefore unsuitable. In support of this position they argued that numerous assets in the investment accounts are sunk or inert due to mistakes in investment policy, declines in demand for passenger and express services, and inadequate write-offs[112,pp45-58].

From a practical perspective, the provinces presented evidence to the effect that the railways, despite their low reported rate of return on net book value, were making substantial investments in the railway using internally generated funds. As an explanation they[112,pp50] made the following observation and supposition:

> This apparently low average rate of return on book value, combined with a surprising ability to finance reinvestment from retained cash flow, is also typical of U.S. Class I railways. It suggests that the net rate of return may not be an appropriate measure of adequacy of earnings on the railway.
>
> One possible reason for this is that the rate base does not reflect the economic value of the property employed, and in fact overstates the long run capital requirements of the railway.

Advocates of the rate base-rate of return argued that the apparently low rate of return on rail net investment, the low ratio of earnings to book value of rail equity, and the low ratio of market price to book value of rail equity indicated the failure of past regulatory policy to provide adequate freight rates and earnings for the railway. However, as the Provinces pointed out, this argument has a fundamental flaw. It ignores the market place where investors, in order to earn their required rate of return, bid down the share price. In fact, the market value of Canadian Pacific equity in the ten years prior to the cost inquiry had been consistently below book value.

In addition to the problems with the asset base, the Provinces argued that the rate base-rate of return formula was not appropriate for the costing requirements on the new Act. They pointed out that, under the rate base-rate of return method, the cost of capital, in a dollar cost, is the annual interest charge which the railways would have to pay to financial institutions in the securities market in order to borrow the value of the reported investment in rail property. With particular reference to the cost of capital for subsidy purposes the Provinces stated, "the relevant issue is not the rate which must be paid to get capital from the debt and equity markets; but the rate which must be paid to keep CPR in the railway business" [112,pp47]. In the following general statement, the Provinces[112,pp48-49] presented alternative view of the cost of capital concept.

> The accounting procedure described above (rate base determination) bears little relation to the concept of economic costs, which is the loss in value of economic

> output, when one type of service is producéd rather than others. Capital cost is the economic productivity of the capital used here rather than elsewhere plus the value of resources needed to maintain capital intact. This cost is not measured appropriately by summing the depreciation on existing capital and the interest cost of the yet undepreciated capital. The existing capital is truly sunk, in the sense that it has little productivity in other uses. The proper cost of capital is the flow of cash needed to maintain the capital stock intact over time in order to maintain service (the cash investment outlays), plus the cost of interest and dividend payments needed to satisfy the expectations of holders of the firms securities and, if necessary, to attract new funds from the capital markets.

An approach to measuring the cost of capital, called the cash flow cost of capital was advocated by the provinces as an alternative to the rate base rate of return. It is basically a modification of the requirements formula and is the foundation for the funds flow model analyzed in this paper.

In advocating the cash flow model the Provinces argued that it had two major advantages over the rate base rate of return. First and most importantly it does not require an accurate measure of the asset base. Secondly, the provinces argued[67,pp52] that it provides a better measure of the opportunity costs of the resources employed in regulated services.

> Under the Transportation Act,...the regulatory commission has little effective control on the overall level of rail rates or earnings. As a consequence the actual earnings of the railway will provide a measure of the yield which the railways can earn on the capital under the present state of demand for rail service, rail costs, technology, efficiency, and competition from other modes. With large segments of the rail rates and traffic freed from regulatory control, it is appropriate to use the return earned on unregulated traffic, and as a measure of the cost

> of capital for avoidable cost decisions[34] as well as decisions involving compensatory rates

The CTC rejected the use of the cash flow model on the grounds of circularity; that is, profitable railways would automatically justify high rates of return and unprofitable railways would justify low rates. It was further argued that, to the extent the capital costs determined using this method affect subsidies and rate levels they then could become self-fulfilling.

In adopting the rate base-rate of return, the CTC accepted the net book value of the various investments as being the rate base for Canadian Pacific. However, in face of some of the evidence presented, the CTC[29,pp359] did express some reservations concerning the valuation of the asset base.

> The Governments of the Provinces contended that because of the over statement of the investment values of the railway property of Canadian Pacific any generally acceptable rate applied to such investment will result in a rate of return that is excessive when compared with the recent earnings record of Canadian Pacific. As the extent of over statement of Canadian Pacific net investment cannot be accurately determined, it would be very difficult to fix a rate applicable thereto which would provide an appropriate rate of return.... The contention that the true economic value of the Canadian Pacific net investment base is overstated is to some extent valid, as is demonstrated by the railway's desire to abandon a portion of its branch line and passenger property.

The one area where the asset base is adjusted to its economic value is the valuation of the investment in track and structures on those branch lines being costed for abandonment and subsidy purposes. The investment in an unprofitable branch line is said to be a "sunk cost".

As such, the assets' valued in their next best alternative is the net proceeds of salvage.

Although the CTC did not make a specific determination as to the percentage rate of return, they[29,pp360] did outline six guidelines for calculating the rate of return appropriate for Canadian Pacific. Included in these was the following expression of the need to take into consideration the over-valuation of the asset base:

> The rate of return should be lower than a rate calculated by means of the conventional rate base-rate of return method. The effect of inert assets in the Canadian Pacific net investment base is to inflate the equity portion of the railway's capital structure. Since equity normally requires a higher rate of return than debt-particularly if income tax is included- a return calculation using net book investment results in a rate which is higher than reasonable when applied to specific items of investment.

The Cost Order only went so far as to set guidelines for setting the rate of return. These guidelines included only one adjustment in the rates of return for the various end uses and that was in the treatment of income tax expenses. For purposes of abandonment and subsidy income taxes were to be excluded and for purposes of minimum and maximum rate regulation they were to be included. The rationale for this distinction was simply that a service which is uneconomic is not incurring income tax expenses.

In summary, the issuance of Cost Order R.6313 marked the end of the requirements formula in favour of the rate base-rate of return formula. However, in doing so the Commission expressed numerous reservations about the use of net book value as a rate base.

1.5. MODIFICATIONS TO THE COST ORDER SINCE 1969

During the late 1970's and early 1980's there were three major regulatory proceedings which led to significant changes in the procedure used by the Commission in making its annual cost of capital determinations. The main impetus for the review came from the Minister of Transport in 1977, who by an Order-in-Council instructed the CTC to review its Cost Order and accounting regulations.

The reasons for the review arose primarily from the deficiencies in the existing methodology identified in two specific costing studies; one on grain[20] and the other on passenger[135] services. In addition there were also some applications under Section 23 of the National Transportation Act and some branch line abandonment cases where the costing regulations were found to be lacking[35].

Paralleling the review of the Cost Order were two other related initiatives, which for reasons of legality and administration had to be dealt with separately; the issues of the inclusion of income tax as a cost and the need to revise the accounting system. The first of these was an application by the railways on March 28, 1977, to have the costing regulations amended to the effect that an allowance for income tax should be made in cost of capital applications for subsidy purposes on uneconomic branch lines and passenger services. When the income tax cost was excluded from the cost of capital for subsidy purposes, the subsidies were viewed as temporary compensation systems which would disappear as the system rationalized itself. However, the protection of Prairie branch lines from abandonment until the year 2000 and the creation of VIA Rail changed this. The Commission, therefore, concluded that an allowance for income tax was now appropriate[116,pp13] for compensation payments.

A number of other important cost of capital related issues were raised during the course of the hearing. The Commission's decisions on three of these issues have a direct bearing on the assumptions used to develop the funds flow model and are, therefore, summarized below:

a. Accumulated deferred taxes should be explicitly recognized in the capital structure and assigned a zero cost rate in the annual determinations of the composite cost of capital[116,pp18].

b. The income tax rate to be used in providing an allowance for income tax should be the basic federal corporate tax rate less the rate of federal abatement for Provincial corporate taxes plus an appropriately weighted average of Provincial corporate income tax rates (the statutory rate). The rate so determined for any particular year will be subject to modification if appropriate in the circumstances to allow for the effects of capital gains and losses, investment tax credits, and surtaxes that may be relevant to that particular year's determination of the rate[116,pp26].

c. With regards to Canadian National, which at the time of the hearing was not paying income tax[36], the Commission found that an allowance for income tax should be included in the cost of capital for subsidy purposes[37] but only to the extent that it is in either a tax paying or tax deferring position for a particular year after having taken the maximum possible advantage of the available loss carry-over position to eliminate income tax liabilities[116,pp35].

The second issue pursued by the Commission separate from the overall review of the Cost Order was the revisions to the Uniform Classification of Accounts (UCA). Although it was modified from time to time, the UCA had not been reviewed since 1955. In fact the 1955 UCA was based upon the Uniform System of Accounts for Railway Companies, a classification of accounts issued by the United States Interstate Commerce Commission in the early 1900's. Except for two issues the vast majority of this extensive exercise can be ignored for purposes of this paper. The Commission's decisions on the composition of the balance sheet and the accounting procedures for track renewal have an impact on the cost of capital calculations.

In developing a balance sheet for the railway, the Commission only specified the elements for the left-hand side of the balance sheet and was silent regarding the right-hand side. As a result, the capital structure for the railway component remained unspecified[115,pp24].

The second issue concerned the accounting for programmed replacements[38]. The UCA sanctioned the current method of accounting for track structure which is, in effect, partially depreciation accounting and partially betterment accounting[39]. Accepting the railways' arguments that a change to full depreciation accounting would not necessarily yield significantly improved accounting results in the long term and would cause major transitional costing problems, the Commission elected to retain the old accounting methodology. This decision was based on the assumption that, when the existing procedure is in a stable state[40], "the labour and other costs charged to expense in the programmed replacement would parallel, approximately, corresponding depreciation charges, had these amounts be charge to capital"[115,pp28]. Perpetuating this accounting treatment, in the opinion of its opponents, at the hearing, contributes nothing to establishing confidence in the railways' claimed asset bases.

The actual review of the Cost Order proceeded over the time period that hearings were held in respect of the income tax and Uniform Classification of Accounts issues. Of all the issues considered in the review process, the cost of capital was identified as the one requiring immediate attention. As a result, in December of 1980 a Cost of Capital Technical Committee was formed to discuss the issues pertaining to the Canadian Transport Commission's cost of capital methodology. This Committee completed its work in November of 1983 and a hearing was scheduled for May of 1984. The issues not resolved by the technical committee and addressed at the hearing are identified on Table IV-1.

Not appearing on Table IV-1 are a number of issues which were either resolved or, by agreement between the participants, withdrawn from consideration. Three of these are of particular interest to this study because they related to the asset base valuation.

a. Opportunity Cost Approach: The Canadian Transport Commission's "Railway Costing Study: Phase Two Report"[28] advocated an opportunity cost approach to both the cost of capital rate and the rate base. In reaching this conclusion the study team[28,Vol.Two,pp63] noted that the existing costing system, with its use of historic book value as the asset base, is based on the following erroneous assumptions:

> The present costing system is interpreted as being based on the notion of capital as a prerequisite of production, where current goods and services are considered to have been responsible for past capital expenditures, and are therefore to be properly charged some portion of these earlier expenditures. The present approach also involves the assumptions that provision of these goods and services imposes no future costs, and that actual traffic is not very different from traffic expected at the time of investment.

b. Current Value Cost of Capital: Canadian Pacific and Canadian National Railways submitted a proposal to use a current value cost of capital formula[39,Issue Paper B]. This formula is designed to recapture the cost of an investment with a series of cash flows whose time path has the same rate of growth as the cost of replacement. Irrespective of the growth rate, the present value of the cash flows was to equal the initial cost of the investment.

c. Fund Flow Analysis: In their initial position papers[111] the Provinces had again proposed that the funds flow formula be used as one measure of the railways' cost of capital. The details of this approach will be described in the next chapter and will, therefore, not be elaborated on here. As in the past, the Provinces' motive in advocating this formula was to provide an alternative method which does not require an accurate measure of the asset base.

It is interesting to note that, taken together, the removal of these three issues effectively removed the broader issue of asset base

Table IV-1

Issues Considered by the
CTC Cost of Capital Review

Issues	Description
1. Alternative Methodologies	
a) Rate Base - Rate of Return Formula	Appropriateness for railway regulation.
b) Opportunity Cost of Capital Approach	Marginal cost approach.
c) Fund Flow Model	Alternative to rate base-rate of return.
2. Asset Base	
a) Current Value	Should assets be valued at their current value?
b) Inert Assets	Should the asset base be adjusted to remove unused and under utilized assets?
c) Working Capital	Identification of the appropriate amount of permanent working capital.
d) Depreciation	Is there a need for more specific asset groups for depreciation purposes?
e) CN Rail	Are CN Rail's road property accounts adequate?
3. Cost of Equity Capital	
a) Alternative Methodologies	The determination of which methodologies should be used by the Commission.
b) Cost to CP Rail	How to separate CP Rail from CP Ltd.
c) Cost to CN Rail	Cost to a Crown Corporation?
d) Risk Adjustment for Subsidized Services	Are subsidized services less risky?
4. Cost of Debt	
a) Foreign Currency Debt	Who should bear the foreign exchange risk?
b) Premium on Preferred Shares	Is the premium equity?
5. Other Issues	
a) Capital Structure	Should there be a notional capital structure?
b) Donations and Grants	What return should be allowed?
c) Tax Rate	Which tax rate should be used?

valuation from the scope of the review. The issues which remained focused primarily on the cost of capital rate[41]. Most of these will be drawn out in the subsequent discussion of the current methodology.

2. CURRENT COST OF CAPITAL METHODOLOGY

The methodology used by the Canadian Transport Commission for setting the cost of capital rate is very similar to that used in public utility regulation. Very little was known about the Commission's approach to setting the cost of capital rates until the Snavely Commission [20] and the Cost Order Review[28]. Prior to these reports, the focus had been on general issues and principles with very little attention to the mechanics of the process. Up to 1979, the Commission's cost of capital determinations were merely pronouncements of the cost of capital rates to be used for purposes of the various Sections of the Railway Act. It was not until after the Cost Order Review focused on the cost of capital that supporting documentation accompanied the annual determination[42]. However, these supporting documents provide only the data used in setting the rate and not the reasons for the actual rates chosen.

The following description of the Commission's methodology is broken down into the basic components of a rate base rate of return calculation: the asset base, capital structure, cost of debt and cost of equity. In addition, when the cost of capital is viewed in a practical context there are a number of issues which arise such as the proper treatment of deferred taxes, donations and grants, and working capital. In the preceding section a number of special problems which arise from Canadian National's status as a crown corporation were presented. Since the current procedure focuses on Canadian Pacific as the "yardstick" railway, the adjustments necessary to accommodate Canadian National are presented in a separate section below.

2.1 RATE BASE

The rate base has three very important roles in the Commission's methodology. Not only is the asset base used in calculating the cost of capital in total for the railway, it is also used as the basis for constructing the capital structure for the railway and for the allocation of capital costs to specific services[43]. Despite the many problems with the historic net book value, it is used as the asset base.

In the Cost Order[29] the Commission required that the approved cost of capital rate should be lower than a rate calculated by means of the conventional rate base-rate of return method to account for inert assets. In other regulatory jurisdictions considerable effort is often expended to ensure that the asset base is composed of 'used and useful' assets. The CTC does not do this to any great extent except to ensure that unused assets are removed from the books. The CTC does not make any adjustment for those assets "which have lost their earning power in whole or in part"[30,pp60]. In this regard some regulators[44] have made adjustments to the asset base to eliminate excess capacity. In the railway context it is argued that such assets, while actually being used to some degree, "contain an element of inertness in the sense that their book value for costing purposes is greater than is needed for the efficient production of transportation services"[30,pp60].

2.2 CAPITAL STRUCTURE

On numerous occasions in this paper it has been noted that neither railway is a separate corporate entity. Consequently, the capital structure has to be determined before a weighted average cost of capital can be calculated. Current procedure is to calculate the capital structure based on changes in financial position from year to year.

The base year for the calculation is the so called "split balance sheet"[45] submitted to the next Board of Transport Commissioners in 1949 as part of the 20 per cent case. The following is an abbreviated description of the computation which CP Rail uses in its cost of capital submission[39,Issue Paper C].

a. Net investment in the rail property is calculated by deducting from gross investment the sum of accrued depreciation, donations and grants, and deferred taxes and then adding back the value of securities held by the public in leased railway companies.

b. The debt assigned to the rail division is computed as the sum of the following:
   1. Equipment trust certificates secured by railway property and leased line securities.[46]
   2. Commercial capital leases.
   3. Collateral Trust Bonds which are assigned to the railway based on an analysis of the railway's sources and application of funds. Any change in cash position results in either an increase (if the cash

position decreases) or a decrease (if the cash position improves) in the amount of Bonds allocated to the rail subcomponent.

4. Perpetual bonds are assigned to the railway based on a ratio of the investment in the railway to the total investment in all of CP Limited.

c. The preference and preferred stock are also allocated to the railway based on its proportion of assets.

d. Deferred taxes are included in the capital structure for purposes of computing the cost of capital for imposed public duties and excluded for purposes of computing the cost of capital for rate making.[47]

e. The amount of equity capital (ordinary stock and retained earnings) is calculated as the residual amount necessary to equate the left and right hand sides of the balance sheet.

The procedure proposed by CN Rail to calculate their capital structure is essentially the same as that used by CP Rail. However, to date the Commission has not accepted the capital structure submitted by CN Rail for the base year (1978).

The fact that the use of this formula is open to manipulation[48] and yields very high equity ratios (approximately 70%) has made it one of the most important issues to be resolved at the cost of capital hearing.

2.3. COST OF DEBT, PREFERENCE STOCK AND PREFERRED STOCK

Current procedure is to use the weighted average embedded cost of debt rate for the debt instruments allocated to the rail component of the company. Where necessary adjustments are made to reflect premiums and discounts on the sale of the issue or foreign exchange rates. With the new rules for the accounting treatment of long term capital leases, the interest rate costs implied in the lease has to be separated out.

The cost of preference and preferred stock are also taken at their nominal rates recalculated to effective rates based on the net proceeds of the sale.

2.4. COST OF EQUITY CAPITAL:

The approach used by the Commission in setting the cost of equity rate can be described as one of informed judgment. Recognizing that there are several methodologies which can be used to estimate the cost of equity capital, each of which can produce a different estimate, the Commission examines the results of ten to thirteen[49] calculations. In reports issued by the commission[117][118][119][120][121][122] supporting its cost of capital findings the results of the cost of capital calculations are accompanied by a qualifying statement such as:

> While each method can produce an estimate, it should be noted that, depending on the assumptions employed, the estimate can fluctuate considerably. In view of this, reliance on any one methodology is rejected; [119] or
>
> While these approaches (cost of capital methodologies) can be used to directly estimate the cost of equity, the staff placed little faith in their ability to provide accurate point estimates and recommended that their results be used simply as barometers[120].

To date the Commission has not approved a separate cost of equity rate for CN Rail. CN Rail has made submissions to the Commission but these have not been accepted and the Commission has opted to have CN

Rail use the rate approved for CP Rail. Therefore, this discussion will focus on the data used to calculate the cost of equity for CP Rail.

The methodologies used by the CTC to measure the cost of equity capital for CP Rail are listed on Table IV-2 along with the estimates generated in each of the years 1979 to 1982. Table IV-3 then presents the CTC's weighted average cost of capital determination for each of these years. Since three of the methodologies have not been previously discussed, a brief explanation of these is given below:

> a. Status Quo: As a bench mark the approved cost of capital rate for the previous year is brought into the current year's rate setting process.
>
> b. Snavely Methodology: In two of the four years in which the Commission has published its reports on the cost of capital, Mr. Snavely produced updated reports on the costs of transporting grain by rail. Like the Commission's determination, Snavely used a number of methods as inputs to the process of setting a cost of equity rate.[50] The one aspect that distinguishes the approach taken by Snavely from that of the Commission is that Snavely's calculations assume the cost of equity capital to CP Rail is identical to Canadian Pacific Limited's.
>
> c. Canadian Pacific's Claimed Rate: Each year CP Rail makes a detailed submission to the Commission supporting its claimed cost of capital rate. The methodology varies from year to year but, generally speaking, the claimed rate is a simple average of the rates calculated using the following methodologies:[51]
>
> 1. Equity risk premium above CP Ltd. bond yield
> 2. Discounted cash flow
> 3. Capital asset pricing model
>
> Most often the railway uses different variations of the models, data, and assumptions than the Commission.

As can be seen from the tables, the models yield a wide range of results from any one year. In addition, there is very little

Table IV-2

Cost of Equity Capital
Alternative Approaches Used by the CTC for CP Rail
(1979-1982)
(Excludes an allowance for Income Tax)

Approach	1979	1980	1981	1982
CTC Determination	14.55	15.55	16.80	15.80
1. Based on the Snavely approach (cost for the parent company)	14.50	18.00	n/a	n/a
2. Canadian Pacific's claim	17.50	22.22	22.30	21.34
3. Equity Risk Premium on CP Rail Bond Yield	14.54	16.53	19.46	19.63
4. Discounted Cash Flow				
- with weighted data	29.90	26.41	22.11	11.29
- with unweighted data	17.50	17.40	16.82	14.96
5. Capital Asset Pricing Model				
- with weighted data	19.25*	n/a	19.82*	16.92
- with unweighted data	15.09*	n/a	16.62*	15.59
6. Capital Asset Pricing Model Using Modigliani and Miller Adjustments				
- with weighted data	21.68	26.48	20.73	n/a
- with unweighted data	16.29	21.19	16.80	n/a
7. Capital Asset Pricing Model using the Brian Belt Adjustment				
- with weighted data	18.04	21.73	15.76	n/a
- with unweighted data	15.09	19.30	12.09	n/a
8. Earnings Price Ratio	14.98	19.72	19.40	17.23
9. Opportunity Cost - Earning on Book Equity for TSE 300				
a) Unadjusted	18.50	17.30	12.40	6.90
b) Adjusted for market to book ratios	16.20	13.00	9.84	6.76

* The CAPM as calculated for 1979 but was used as input to the two CAPM models listed below.
n/a: not available.

Table IV-3

Summary of CN & CP Approved Cost of Capital Rates (1979-1982)

	1979	1980	1981	1982
1. Cost of Equity				
CP	14.55	15.6	16.8	15.8
CN	-	-	16.8	15.8
2. Cost of Debt				
Embedded				
CP	5.26	5.86	7.28	7.82
CN	-		9.50	11.66
Market (CP)[1]	11.24	13.22	16.23	16.33
3. Cost of Preferred and Preference				
CP	2.2	2.11	1.91	1.73
CN	-	-	-	-
4. Weighted Average Cost of Capital For:				
a) Subsidy				
CN	11.59	12.43	13.85	13.30
CP	18.56	20.82	21.30	19.70
b) Application[2]				
CN	11.50	12.43	13.85	13.70
CP	11.50	12.52	13.42	12.90
c) Rate Making[3]				
Commercial Traffic	21.51	24.35	25.69	24.2
Grain Traffic			20.50	19.50

Notes:
1. Branch line and passenger service includes income tax where there is a tax liability.
2. Branch line abandonment and passenger service discontinuance. No tax liability is included.
3. Minimum and maximum rate regulation, rapeseed product rates, grain rates set under the Western Grain Transportation Act. Includes provision for income taxes. CN is assigned by law, CP Rails cost of capital rate.
4. Grain traffic rates shown for the crop year. Therefore 1981 rates are a weighted average using months and apply to the 1981/82 crop year.

consistency in the changes from one year to the next between the models.

While the exact reason for the rates which are ultimately accepted are not given, it appears that considerable weight is given to the general direction and magnitude of change from one year to the next. Changes in the effective yield on long term bonds provides a primary "bench mark" used to measure the annual changes.

Given the range of outputs from the various methodologies it is obvious that the Commission must exercise judgment in making its annual determination. In exercising the judgment it is not clear whether or not the Commission, through its decision making process, is setting a fair rate of return or determining, as best they can, the cost of capital to the railway. Even though the legislation refers to the cost of capital, there is some circumstantial evidence which indicates the Commission does take into consideration some factors characteristic of a fair rate of return determination.

a. A number of the cost of capital methodologies such as, CAPM, comparable earnings etc, rely on market data which reflects current market conditions. To the extent markets are imperfect, this market data will yield rates consistent with the concept of "second best".

b. In dealing with controversial issues such as capital supplied through donations and grants,[52] deferred taxes[53] etc., the Commission endeavors to be fair and to not create disincentives to railway investment.

c. Under the 1967 National Transportation Act the railways are expected to be self-sustaining viable organizations. Consequently, the Commission must give some weight to the overall revenue requirements of the railway when setting the cost of capital rate.

This evidence is certainly not conclusive. However, it does point to some elements of fair rate of return considerations in the Commission's cost of capital determinations.

3. CRITIQUE OF CURRENT COST OF CAPITAL METHODOLOGY

To this point in the paper information has been presented on the theoretical and practical aspects of both fair rate of return and cost of capital ascertainment. Given the legal requirement for the costing of specific services, it is not surprising that the emphasis is on the cost of capital estimating methodologies. This is not to say the fair rate of return considerations are ignored. In today's imperfect economy regulators must explicitly or implicitly take into consideration the problems of second best, efficiency, incentives, and achieving the levels of investment and service desired by society. The combination of the inability of any of the models to estimate the cost of equity capital precisely and the arbitrariness of rate of return considerations make it impossible to critique the existing procedure in terms of its accuracy. Consequently, the current procedures must be evaluated in terms of the reasonableness of their assumptions, the theoretical validity of the procedures, and the practical problems of implementation.

Generally speaking the approach to cost of capital estimation employed by the Canadian Transport Commission is relatively contemporary. The rate base-rate of return formula is the norm in the regulation of public utilities[54]. In the implementation of this formula, the Commission relies on a number of market based cost of capital estimating procedures and de-emphasizes the accounting based procedures. Like most other regulatory jurisdictions, the maintenance of financial capital, as opposed to physical capital, is the standard used by the Commission.

Contemporary or not, there are some serious problems with the use of the rate base-rate of return formula and many of the cost of capital estimating procedures. A number of the problems to be described below are inherent to the rate base rate of return formula and cost of capital estimating procedures. Others are unique to Canadian railway regulation.

This critique of the existing procedure will look at the two elements of a rate base-rate of return computation, the asset base and the fair rate of return. As expected from the historical overview at the start of this chapter, the most serious concern has been with the measurement of the asset base. Consequently, this area will be examined first. In the description of the various cost of capital estimating techniques contained in Chapter Two some of the major problems of each of these were discussed. The discussion here will focus more on the practical problems associated with using the various models encountered in their application to railway regulation. Finally, even if the asset base and cost of capital were measured correctly, there remains a number of concerns with the rate base-rate of return formula which need to be expressed.

3.1. ASSET BASE

Almost all regulatory jurisdictions employ a historic value rate base for rate base rate of return computations and the Canadian Transport Commission is no exception. However, the use of the historic book value of the assets is based one very important assumption. There is an implicit assumption made in Canadian railway regulation that the market value of the railways is equal to its net book value.

From the theoretical perspective presented in Chapter II the proper asset base in so far as equity capital is concerned is the market value of the assets. Consequently, where the historic book value is used as the asset base it is implicitly assumed that the market value equals book value of the firm. In practice this is an extremely rare occurrence. However, there is just as significant a problem with the use of a market value asset base. As Bonbright[12,pp216] points out, "regulatory commissions are not finding the values of property they are making it". It is in an effort to avoid this circularity that regulators must choose an asset valuation system independent of the market value of the firm. For the reasons given in Chapter III the historic book value is, with very few exceptions, the choice of regulators.

The use of the historic book value for purposes of railway regulation presents a number of sources of potential error if it is overstated. The CTC accepts the net book value without seriously questioning its economic validity. In the next chapter it will be demonstrated that there is reason to believe the asset bases are indeed overstated.

From the description of the current cost of capital methodology it is obvious that a great deal hinges on the asset valuation for CP Rail. First of all it is the yardstick used by CN Rail to ascertain its net investment figures and in costing individual services[55]. Secondly, the net investment indirectly determines the capital structure. This occurs because the amount of equity capital allocated to the railway is determined by the size of the net asset base[56].

3.2. COST OF EQUITY CAPITAL ESTIMATING TECHNIQUES:

Earlier in this chapter it was noted that the Commission employed a number of estimating techniques to determine the cost of equity capital for CP Rail. As there is relatively little difficulty in estimating the cost of debt, the focus here will be on some of the major practical problems encountered with the various models used by the Commission. In general, the results of these various models yielded such a wide range of estimates in any given year that their usefulness has to be questionable. Even variations of a model, such as weighting the annual observations or changing the time period used in the analysis, causes the estimated cost of capital to fluctuate over a wide range.

3.2.1. Capital Asset Pricing Model (CAPM):

Although there is general support for the capital asset pricing model from a theoretical perspective, there are widely differing opinions on its usefulness in regulatory proceedings. The attractiveness of CAPM is that beta, as a theoretical construct, is useful even though it is not directly measurable. In some ways it is similar to other theoretical constructs such as demand schedules and utility curves. In support of the continued use of the CAPM in regulatory proceedings the Commission [28,Vol.2,pp35] argues that, "the capital asset pricing model offers the greatest potential to inform regulatory judgment in a fully integrated, consistent, and relevant manner". However, in when utilizing the model the Commission[120,pp7-8] did acknowledge its limitations.

> They(the CAPM models) have been included in this report because of the controversial nature of the model but it should be noted that a growing number of financial analysts are expressing grave doubts regarding the use of Portfolio Selection Theory as an estimator of a firm's cost of equity capital. Their valid concerns on the use of historical data as a substitute for market expectations, the sensitivity to the time period analyzed, the stability of the Beta over time, the lack of empirical support, and the "ivory tower" assumptions which must be made should illustrate that caution must be exercised when relying on the model to provide a firm's cost of equity capital. Nevertheless, the model has a certain intuitive appeal since it basically states that the yield investors require on a specific share is equal to the current risk-free interest rate, plus a risk premium which is specific to that firm.

Empirical studies on the CAPM have identified a number of significant problems with the model when it is used to estimate the cost of equity capital. While not arguing with the theoretical basis of the CAPM, research by Friend and Blume[56]; Black, Jensen, and Scholes[6], and Blume and Friend[8] has yielded the general conclusion that the original CAPM does not appear to provide an adequate description of the equilibrium structure of expected returns. The rationale offered to explain these conclusions are varied but, in general, all point to the validity of the assumptions used in the model.

The empirical problems with using the CAPM increase drastically when the model is used to estimate the cost of equity capital for an individual firm. Hagerman[61,pp20] identifies the major difficulty as follows:

> Observable beta coefficients must be estimated from past data, so an implicit assumption in using the beta coefficient is that a firm's beta is constant over time. If this assumption does not hold, then the estimated beta coefficient will be a weighted average of past betas and will not be a relevant measure of the current risk of the firm.

The stability of the beta coefficient has been tested by Sharpe and Cooper[131] and Blume[8]. Both these studies concluded that the large amount of unexplained variance in the beta from one year to the next may make the beta coefficient an inadequate basis for estimating the cost of equity for an individual firm. Following upon the Sharpe and Cooper study, Hagerman[61] focused his analysis on public utility stocks. Even though he did find greater stability, it was not enough to make the betas reliable predictors. This lack of stability in the beta has been attributed to two causes[61,pp21]:

1) The true beta coefficient may change over time.
2) The estimated beta coefficient will differ from the true beta because of sampling errors.

The significance of the latter problem is exemplified by Hagerman's study[61] which shows that a 95 per cent confidence interval for an average beta would range from .4 to 1.6. Since the sampling error is unique to the firm, Hagerman observes that the error cannot be reduced by using a larger sample of comparable firms. The reason the sampling error is unique to the firm is that the beta measures the variation in the stock which are systematically related to the market index yield. Consequently, when dealing only with a single stock, the diversification or averaging affect of the portfolio is absent.

Some additional evidence is available which provides support for using the CAPM on individual securities. It has been argued that the CAPM is more reliable when the beta of the firm is close to 1.0[39,pp15]. For 1978 and 1979 the betas computed by the Commission[119,pp30] for Canadian Pacific Limited were 1.02 and 1.03 respectively[57]. In addition, there is evidence that more stable results can be achieved by using a portfolio of stocks with similar levels of systematic risk[8][46]. There is also evidence to suggest that the betas estimated for individual firms in the same industry group tend to be clustered reasonably close to an industry mean [28,pp97][58]. Thus, the use of a beta for a portfolio of similar risk securities is sometimes used to operationalize the CAPM for an individual firm. The Commission has not to date done this most likely because the beta of CP Ltd. so closely proximates that of the market.

When the CAPM is used to estimate the cost of capital for an individual company a number of practical problems are often encountered. Breen and Lerner[17] demonstrated that measures of beta depend on the estimating equation used, the choice of the market index and the specific time period selected[59]. Even from the two variations of the CAPM (Modigliani and Miller and Brian Belt adjustments) used by the Commission a wide fluctuation in the estimated cost of equity capital could be observed. As was pointed out in Chapter II, there are numerous variations of the CAPM available. However, like the two variations used by the Commission, they tend to alter only one of the major assumptions but not a combination of these assumptions. As expected, each variation changes the estimated beta but without knowledge of the true beta it is not possible to say which variation is superior. Starting in 1982, the Commission discontinued the calculations of the Modigliani and Miller and the Brian Belt adjustments and presented only the results of the basic CAPM analysis.

The choice of the market portfolio and the measurement of the return earned on that portfolio can have a significant affect on the estimated beta. The ideal is a value weighted portfolio of all risky assets. Since this is difficult to obtain a market index such as the Toronto Stock Exchange 300 is used. Computation of the return on the market is usually a measure of capital gains adjusted for dividends. In practice this can be a very difficult task.

Probably the most important factor affecting the CAPM estimates is the time period over which the analysis is conducted. Proponents of a short time frame argue that recent market conditions provide the best estimates of current market expectations. The difficulty which arises is that the beta becomes very unstable and the statistical significance of the results deteriorates. From the other perspective, proponents of longer analytical periods argue that the estimated beta is more stable. However, the price of the increased stability is to make the model insensitive to current market conditions especially if there is a major change in the market place during the study period. There is no consensus on the optimal time period but it would appear that a 5 to 10 year period is most often used. A paper by Gonedes[57] concludes that "predictions of future systematic risk based on market model regressions involving five to seven years of monthly data are superior to predictions from regressions using either shorter or longer observation periods".

A compromise occasionally used to resolve the time period problem is to weigh the observations in a manner similar to that used by the Commission. Usually the weighting scheme is designed to give more emphasis to the more recent observation. However, the weighting scheme is arbitrary and a different weighting scheme will yield very different results.

The CAPM is relatively popular with regulatory agencies despite its short-commings. Its value is as a market based measure of the cost of equity capital and, as such, provides decision makers with information. Even though the actual cost of capital estimated for the individual firm should be used with caution, it does provide information about the impacts of changing market conditions on the firm's cost of capital.

3.2.3. Risk Premium Approach: Even though the risk premium approach used by the Commission is quite arbitrary it is accorded a relatively high importance in the decision on the cost of equity rate. The difficulty lies in the arbitrary nature of the premium. It is the only market based approach used by the Commission wherein an adjustment, albeit arbitrary, can be made for the risk of the railway relative to the parent company.

In the 1979 Cost of Capital determination for CP Rail, the Commission[119] presented the following evidence in support of their selection of an equity risk premium of 3.3 per cent.

a. Nesbitt Research Annual Total Returns on Bonds and Equity over the period 1956 to 1979, when averaged, yield a 1979 equity premium of 3.9 per cent for 1978 and 5.6 per cent for 1979.

b. The Snavely Commission use of 4.0 per cent. This was the spread between American Telephone and Telegraph Co.'s 1974 bond yield and the Federal Communications Commissions allowed rate of return.

c. A value of 5.4 per cent was determined by Ibbotson and Singuefield in a study of bond yields over the period 1926-1976.

The results of these various estimates demonstrate the wide range of results which are possible with the risk premium approach. Obviously, the Commission, without explicitly saying so, believed CP Rail to be less risky that the average. Without an unambiguous measure of risk[60] this approach must rely on judgment.

3.2.2. Comparable Earnings: The comparable earnings test is probably the most widely used approach to cost of capital estimation used in the regulatory environments. This is not just due to the legal reasons cited earlier but also to a desire by regulators to have an external "bench-mark" for comparison. Such comparisons are viewed as an important factor in setting a fair rate of return in a modern mixed economy. Kahn[79,pp198] observes that, "second best considerations constitute the main economic case for allowing a public utility a rate of return equal to comparable earnings instead of the cost of capital". The same considerations apply to railways, even though they are not totally regulated.

The practical difficulties with the comparable earnings approach are in two parts; the identification of comparable companies and the measurement of the returns on these. There is no agreed upon approach to identifying companies with comparable risk. No matter how it is constructed, empirical studies have shown that an arbitrary categorization of industries should be tested before it is used. An extensive study by Boness and Frankfurter[13] found that risk was not necessarily homogeneous within various industry groups. Caution must also be exercised when other regulated companies are used for comparison. The return earned by these companies reflects their monopoly power and the return allowed by the regulator. Consequently, the return observed on the regulated company may or may not reflect the market cost of capital.

For purposes of comparison the Commission used the Toronto Stock

Exchange 300 on the rationale that the risk of CP Ltd. closely approximates the market. With a beta of about one, such an approach appears valid. However, implicit in this approach is an assumption that the risk of CP Rail is the same as CP Limited. The validity of this assumption continues to be unresolved. In the evidence submitted to both the Snavely Commission and the Cost of Capital Review, there are studies purporting to refute or support this assumption. Each study uses different measures of risk and occasionally, where similar risk measures are used, the results are at variance due to differences in the assumptions, time periods, and data used. In theory[61] and in practice the beta coefficient has been found to be very valuable in identifying comparable firms.

A variation of this calculation is also produced which adjusts the above return on book equity to reflect the market to book ratios for the T.S.E. 300 as a whole. In doing this the Commission recognizes the assumptions which are necessary. Most importantly, it must be assumed that the appropriate market to book ratio for the railway is the same as the T.S.E. 300. Even if it could be estimated, the actual market to book ratio should not be used. Profitable railways would then be able to justify high rates of return while unprofitable or less profitable railways would only be able to justify low rates of return. This is one of the difficulties which are encountered when estimating the returns on the comparable companies. There are many other factors which may invalidate the rate of return comparison even though the companies are shown to have the same risk. Some of these are listed below:

a. Differences in dividend payout ratio
b. Expected growth rates
c. Differences in accounting practices
d. Availability of tax incentives (CCA and Investment tax credits)
e. Government interference in the market place.

Generalizing, most of the risk measures are based on ex poste analysis while the cost of capital is an ex ante concept. Therefore, if future expectations differ from past experience the comparison becomes more difficult.

3.2.4. Discounted Cash Flow Model: Like other measures of the cost of equity capital, the discounted cash flow or dividend growth model, has both its proponents and detractors. The discussion in Chapter II outlined the major theoretical strengths and weaknesses of the DCF models. In general the key problem with the DCF models is not the validity of its assumptions but how to estimate future growth.

Two major problems arises with the DCF model when it is applied to a regulated industry. The first is one of circularity. When a company is regulated, the rate of growth will be influenced by the rate of return allowed by the regulator. This can be seen when growth is defined as the return on the funds retained by the firm (g=br). Where the company is only partially regulated, the problem decreases. The second problem arises out of investor preferences for dividends or capital gains. While dividends are less risky than capital gains investors may prefer capital gains for tax reasons. The DCF model is unable to accommodate this.

Empirical research on the DCF model[97][139], when applied to the market, has shown that it consistently underestimates the return which was actually earned. The reason for this is that the DCF formula will only yield estimates consistent with investor expectations when the market value of the firm equals the book value. Since most non-regulated companies have market values in excess of book values the results of the empirical studies appear consistent. This observation has interesting ramifications for regulators. In those instances where the regulator is interested in the cost of capital or wishes to use the perfectly competitive model as a regulatory guideline, the DCF model has some value. However, where the fair rate of return and second best considerations are deemed relevant, the downward bias of DCF model must be recognized.

The difficulties encountered with the application of the DCF model arise, as expected, with estimating the growth rate. Depending on the time series used and whether the growth rate is calculated based on earnings per share or dividends, wide fluctuations in the cost of capital rate result. Recent years' experience in the Canadian railways have yielded growth rates which are too large to be reasonable expectations of long term growth. This is due primarily to an unusually large increase in earnings in 1979. Even when growth is computed based on the retention rate (g=br), problems are encountered due to changes in the retention rate over the past few years. These problems are circumvented by some analysts[39] by assuming that investors attempt to forecast only a few years into the future. Such an assumption also presumes that there is no relevant information about economic conditions or the firms prospects beyond the short term time horizon. This second condition is somewhat questionable when long term investments are undertaken. Another approach, which is one used by the Commission, is to weigh the data in the time series. Like the CAPM, the weighting scheme has a significant impact on the estimates. However, without supporting evidence, the weighting scheme is arbitrary.

3.2.5. Earnings/Price Ratios: In order to use the earnings/price ratio one or more of the following conditions identified in Chapter Two have to be valid.

1) The firm must expect zero growth and pay all earnings as dividends or
2) The firm must earn an average rate of return on new investment exactly equal to the cost of capital.

This latter condition occurs when the market value of the firm equals its book value.

In the case of CP Ltd., neither condition holds. The company is experiencing a period of growth, particularly in the railway division and is reinvesting large sums of retained earnings into the company. Also the market value of CP Ltd. is below its book value.

3.2.6. Classical Comparable Earnings: This approach is fundamentally flawed and is not used by the Commission. However, it is still a widely used statistic to measure performance. Both the return measured and the asset base of the comparable firms may be derived from different accounting systems and carry no economic meaning. The only area where some use can be found for this measure is to compare results from one year to the next for the same company.

3.3. COST OF CAPITAL TO A CROWN CORPORATION:

To date, Canadian National has used the cost of equity capital rate determined for Canadian Pacific. For the rate regulation sections of the Railway Act and the Western Grain Transportation Act, the legislation specifically states that CP Rail's cost of capital rate will be used for CN Rail. However, for abandonment and subsidy related computations, this rule does not apply. CN Rail has made its own cost of capital determinations but these have not to date been accepted by the Commission.

As a crown corporation, CN Rail does not raise funds on the equity market. Its equity is supplied by the Government of Canada[62] which, under the terms of the 1978 Recapitalization Act[155], is entitled to a return equal to twenty per cent of profits. Underlying the determination of CN Rail's cost of equity is a very fundamental issue which can best be described by examining the two opposing views. On one side it is argued[37,pp277][36] that the appropriate cost of funds is the one which fairly and adequately compensates investors for the risks associated with the service offered. This position is based on the presumption that the risks are inherent in the business and are unrelated to the ownership of the enterprise. In other words, the cost is the opportunity cost associated with the assets employed. As a crown corporation the methods available for estimating the cost of equity capital are greatly limited. In fact, the comparable earnings standard is the only one employed by CN Rail.

The opposing point of view is offered by the Provinces[111][113] who argue that the cost of capital is the opportunity cost to the Government. Over the years CN has had its losses covered by the Government of Canada and had equity created by the recapitalization of railway debts owed to the federal treasury. Furthermore, the provinces argue that the decision to create a government funded corporation reflects a public policy decision to provide services with a capital cost less than available in the private sector. It is therefore concluded that the appropriate measure of the cost of equity rate to CN Rail is the company's current bond rate.

Resolution of this dispute is difficult enough without two additional complicating factors. The first is that CN is not in a tax paying position. If the opportunity cost concept is implemented it would require that the cost rate include a full allowance for income taxes. The Provinces view this as a "windfall" gain to the railway. Also complicating the resolution of this issue is the public policy problem arising out of the situation where a crown corporation is in direct competition with a private company. In this situation, recognition of the lower cost of capital to the crown corporation would provide it with an unfair advantage.

Resolution of this issue is beyond the scope of this paper but, in order to continue, a position must be taken. Therefore, for purposes of this paper it is presumed that CN Rail has a cost of capital different from CP Rail. Whether or not CN Rail should be allowed to use this cost in the computations required by the Act need not be resolved here.

3.4. RATE BASE RATE OF RETURN

The rate base rate of return formula currently used in railway regulation and compensation has been used primarily in the regulation of public utility rates. In the case of public utilities its purpose is to compute the fair rate of return for the regulated entity. Proponents of the formula argue that, if the rate of return is set equal to the cost of capital, it will yield results similar to what could be expected from perfectly competitive market. In addition to the problems of asset base valuation and cost of capital determination which have already been discussed there are some other problems with the rate base rate of return formula when it is used in conjunction with the regulatory provisions of the National Transportation Act. These problems arise out of the differences between public utilities and railways and out of the different approaches to regulation of each industry.

The procedure used by the Commission is very similar to that used in the public utility regulation. Reflecting back on the description of the procedures used by the Commission it is enlightening to explore the comparison between railway and public utility regulation.

There are some very important differences between railways and public utilities which, at the minimum, should result in caution when using the rate base rate of return formula for railways. The Interstate Commerce Commission[71] in its analysis of railway revenue adequacy explored these questions. They found that the only basic similarity between railways and public utilities was that they both require huge capital investments and provide services of unusual public necessity. However, they differ significantly in terms of the economic circumstances surrounding their respective operations. Public Utilities are single firm monopolies which operate in circumscribed markets. As such it is possible to compute rates as the sum of operating costs, depreciation and a fair rate of return. While the utility is required to meet demand irrespective of costs, they are reasonably assured that the protected market will support the resulting rate levels[63]. As a result, business risk is shifted to the customer from the investor.

In contrast the Interstate Commerce Commission[113] describes railways as systems which serve a national market. Since traffic is interlined with other rail carriers and other modes[64], it is very difficult to ascertain single firm revenue requirements. Another and more important difference is that the railways are not able to set rates in the same manner as public utilities. The existence of inter-modal competition restricts the ability of the railway to practice discriminatory pricing. Even where the railways are able to take advantage of relatively inelastic demand for their services, there is a practical limit on rates at the point where the shipper is no longer competitive. The aforementioned studies of railway revenue adequacy[71][73] have consistently found all but a few small railways to be revenue adequate where the rate base rate of return formula is used to measure adequacy. The same situation can be found in Canada. The table on the next page shows the Commission's cost of capital determination for the year 1977 to 1982 and the railways actual performance.[65] These returns show quite clearly that it would take a massive increase in rates or in traffic to earn returns which would satisfy the rate base-rate of return criteria.

Another apparent difference between public utility and railway regulation is that public utility regulators focus on the fair rate of return while the railway regulators focus on the cost of capital. With the current state-of-the-art in cost of capital estimation the cost of capital and fair rate of return are indistinquishable without a full disclosure of all the factors taken into consideration by the regulatory agency in making its decisions.

The rate base rate of return formula was developed for use in conjunction with monopolies which display stable demand, static technology and stable input prices. Quite obviously these conditions are not characteristic of a contemporary railway industry. Therefore, it is not surprising that there was resistance to its implementation and problems in computation.

Table IV-4

Comparison of Actual Earnings with the CTC Approved Cost of Capital Rates (1977-1982)

Year	CTC Approved Rate* (%)	Actual Earnings** (%)
CP Rail		
1977	10.43	4.81
1978	11.13	5.17
1979	11.50	6.49
1980	12.52	7.76
1981	13.42	8.06
1982	12.90	7.35
CN Rail		
1977	10.43	4.76
1978	11.13	5.48
1979	11.50	6.42
1980	12.43	7.20
1981	13.85	7.75
1982	13.70	2.67

* Rate appoved for application Sections of the Railway Act.
** After tax earnings.

4. Summary

This chapter has reviewed in some detail current procedures used by the Canadian Transport Commission and identified a number of the theoretical and practical problems encountered. For the most part, the Commission's procedures could be described as "state-of-the-art". Some of the problems are unique to the Canadian railway environment while others are common to the cost of capital (fair rate of return) procedures no matter where they are applied.

One of the most fundamental issues identified was the appropriateness of the rate base-rate of return formula. It was pointed out that this formula was developed for the regulation of natural monopolies and could, when applied to the railways, result in an overstatement of the cost of capital measured in dollar terms. The move to the rate base rate of return formula was one of necessity rather than a result of the resolution of the debate over the relative merits of the rate base rate of return and the requirements formula. It was the change in policy brought on by the National Transportation Act of 1967 that ended the use of the requirements formula. Administration of the new Act required cost estimates for specific services rather than the railway as a whole. Since the requirements formula could not yield these types of computations, it was dropped.

The requirements formula did not die completely. In the 1969 costing hearings the Provinces introduced the funds flow model as an option to the rate base rate of return formula. As will be shown in the next chapter, this model is a more sophisticated requirement formula which addresses the problem of allocating capital costs to individual services. The model was rejected in 1969 and reintroduced in the 1982-4 cost of capital review. Its attractiveness lies in its claimed ability to divorce itself from the measure of the asset base and provide regulators with an alternative interpretation of the return required by the regulated entity.

One of the most critical and also the most controversial elements of the current procedures is the measurement of the asset base. Its value not only determines the cost of capital (in dollar terms) but also the depreciation costs and the capital structure. Even when the MacPherson Royal Commission opted to use the net book value as the asset base they did so under the assumption that their other recommendations would lead to rationalization of the asset base[66] and more efficient use of existing assets. This concern with the valuation of the asset base also influenced the Commission's decisions in respect of its cost of capital decisions. The guidelines in the Costing Order[29] made provision for a downward adjustment in the cost of capital rate to offset the overstatement of the asset base. Other cost studies such as Snavely[20], the Income Tax Case[116], the review of the Uniform Classification of Accounts[115] and the Review of the Cost Order[28] all had difficulty with the valuation of the asset base.

From a theoretical perspective it was argued that, since the railways are unable to price like public utilities, the rate base-rate of return formula using net book value as the asset base is unlikely to represent the true economic value of the assets. In fact, there is reason to believe the net book value may overstate the economic value of the assets employed by the railway. The reasons for this are considered in more detail in the next chapter.

To date the dispute over the valuation of the asset base has focused on CP Rail. With CN Rail using CP Rail's road property regression coefficients, the validity of CN Rail's asset base can only be more questionable. In the event CN Rail does have its own asset base accepted by the Commission, the same problems as described above are most assuredly to arise.

With both railways being divisions of a parent corporation, it is inevitable that a wide range of practical problems arise in the computation of the weighted average cost of capital. The most disturbing observation is the tremendously wide range of results yielded by the various cost of capital models. Since the "true" cost of capital is unknown, there is no way to conclude that one method of estimation is superior to any other. Furthermore, each model used is very sensitive to its assumptions, the data base, the time period used for analysis, and weighing schemes for data, if any. A change in any of these factors can have dramatic affects on the cost estimate. It is for this reason that the same model can generate very divergent results.

Associated with the cost of capital and rate base issues are a number of perplexing problems. These include the appropriate capital structure; the question of whether a return should be allowed on assets financed by deferred taxes and donations; the appropriate working capital balances; the proper tax rate; and others. The Commission must deal with these and, in so doing, ventures into the range of issues which are characteristic of the fair rate of return determination. As a result the cost of capital and the fair rate of return become inextricable.

Even though there has been very significant progress in cost of capital theory and estimating techniques, it still requires a judgment decision. The procedures used by the Commission are representative of the most contemporary models used by regulators yet they still leave the regulator with a very wide range of possible answers. Attention will now focus on the funds flow model to determine if it can provide useful information to the regulator.

ENDNOTES

1. The Railway Act requires that railways accept all traffic that is offered to them for carriage.

2. Pricing of services such that different levels of rates are charged for different commodities carried similar distances that cannot be traced to differences in costs.

3. In 1967 the Board of Transport Commissioners was later amalgamated with the Air Transport Board and the Canadian Maritime Commission to form the Canadian Transport Commission.

4. For a more detailed description of the Board of Transport Commissioners see Currie[42,pp384-394].

5. This is commonly known as the 21 Percent Case.

6. Canadian Pacific has been used as the "yardstick" for guiding decisions on rates, rates of return etc, for the Canadian National.

7. It is interesting to note that these proceedings addressed the use of current versus historic values of the assets and the relationship between the fair rate of return and the cost of capital.

8. The Commission was initially chaired by C.P. McTague who, after an illness had to resign.

9. When the National Transportation Act is referred to the reference to both the NTA and the Railway Act. The latter was amended in 1969 to correspond with the NTA.

10. In the early 1960's there were a number of labour disputes in the railway industry which added to the political problems faced by the government.

11. When the new National Transportation Act was introduced into the House of Commons it contained a provision to subsidize export grain movements. However, during debate this subsidy was deleted and it was not until The Western Grain Transportation Act was passed in 1983 that a subsidy was paid in respect of export grain.

12. There had been a persistent debate over depreciation rates with the railways preferring a utilization based method and the Provinces a straight-line method.

13. In practice the Canadian Pacific continued to be the "yardstick" measure which was used to determine CN's requirements.

14. Surplus is defined to be an amount allowed for additions and betterments. It can be more correctly described as undistributed profits or retained earnings.

15. Between 1948 and 1958 the fourteen general rate increases which were approved by the board permitted rates to be increased by 155 percent. However, as Currie[42,pp17] calculated the rate increases actually achieved by the railways were only 55 percent.

16. The disabilities referred to are the Statutory grain rates, branch line service, and passenger service. Not mentioned as disabilities but nevertheless important contributing factors were increased truck and waterway competition.

17. The cost of money is quite often used interchangeably with the cost of capital in railway costing studies.

18. In the case of some services or traffic movements the assets employed can be specifically identified. For example, the track and structure employed in a branch line service.

19. Railway profits were declining. Truck competition combined with the grain losses and rapidly increasing costs all combined to make it undesireable to invest any externally generated capital in the railway.

20. Rate levels were set by "class" of traffic with higher value goods being charged higher rates.

21. Agreed charge contracts were allowed by the Transport Act of 1938. They are contracts wherein the shipper agrees to commit a percentage of his traffic to the railway for a fixed period of time in return for rate concessions. By 1957, 12.5 per cent of railway revenues were attributed to agreed charges.

22. The National Transportation Act was introduced into the House of Commons as Bill C-231. In addition to creating a National Transportation Act the Bill also made substantial changes to the Railway Act. Consequently, reference will be made to both Acts interchangeably.

23. Mr. Pickersgill was also the Minister of Transport responsible for having the Act passed through Parliament.

24. Under the new Act the Canadian Transport Commission replaced the Board of Transport Commissioners.

25. To be exactly correct, the CTC must decide that the line is uneconomic and likely to remain uneconomic before abandonment can be authorized.

26. Three months after the Act was passed an Order-in-Council was issued prohibiting abandonment of 18,103 miles of prairie branch lines. These lines were consequently eligible for a subsidy equal to the "actual loss" incurred. For many of these lines this protection has been extended to the year 2000.

27. This Section of the Act has never been used.

28. The basic concept is that the rate should not exceed 250 per cent of the variable costs of the movement on a 30,000 lbs. shipment. Where the weight exceeds 30,000 lbs. the cost savings are shared equally between the railway and the shipper. See Section 278[157,pp6451-6457].

29. Section 32 of The Transport Act[158] also has an appeal mechanism for agreed charges but it will not be discussed here because it is not used.

30. The reader should be aware that there have not been a large number of Section 23 cases. Also it should be noted that the maximum rate formula has only been used once mainly because the ceiling is unreasonably high for modern day heavy car loadings.

31. In direct analysis it is assumed that the investment is 100 per cent variable with output (e.g. rail cars) and the coefficient is simply calculated by dividing the gross investment by the service unit (e.g. car miles).

32. It will be shown later that different cost of capital rates were found appropriate for different regulatory uses.

33. Canadian National has not, to date, made a satisfactory accounting of its assets. In January of 1984, the CTC issued a "show cause" order to CN to explain why they have not done so.

34. Avoidable costs is another way of expressing the definition of variable costs given earlier in the paper.

35. One Section 23 case in particular exposed a number of deficiencies in the costing system. This is what has come to be known as the Rapeseed Case. After almost eight years of litigation and appeals, the Governor-in-Council granted the industry rates set at the minimum compensatory level(rates contemplated by the minimum rate rule). This was the first decision to set cost based rates, something that was not contemplated at the time the NTA was passed or the Costing Order written. In 1983 ,with the passage of the Western Grain Transportation Act, cost based rates were also set for grain.

36. As a crown corporation, CN is not a taxable entity. However, it is expected to make a contribution to the federal government equal to its income tax liability.

37. The calculation of a separate cost of capital for Canadian National is only applicable for subsidy purposes. For rate regulation purposes the Railway Act states that Canadian National must use the cost of capital rate approved for Canadian Pacific.

38. "Programmed replacement" is used to refer to track upgrading and replacement controlled by a railway through budget appropriations.

39. Betterment (Replacement-retirement-betterment) accounting is currently used in the United States by the Interstate Commerce Commission for regulatory purposes. Under betterment accounting, the cost of the original track structure is charged to capital, while the cost of period replacements is charged to expense. If a betterment is made (e.g. heavier rail installed), the proportion of the cost of the replacement related to the betterment is charged to capital and the balance to expense [115,pp36].

40. Stable state is one where there is a steady flow of programmed replacements from year to year.

41. The hearing started in February of 1984 and concluded in February of 1985. It included over forty days of cross-examination on thousands of pages of evidence. A decision is not expected until the fall of 1985.

42. The supporting documents for the 1979 cost of capital determination were not issued until March of 1981.

43. The procedures for doing this were discussed previously.

44. Other jurisdictions such as the National Energy Board do alter the asset base to remove excess capacity.

45 The "split balance sheet" refers to the separation of rail from non-rail investments.

46. Long term leases were given to CP Rail in return for them agreeing to service outstanding securities.

47. The difference in the treatment of deferred taxes arises out of the 1979 Income Tax Case where the Commission ruled that deferred taxes should appear in the capital structure and be assigned a zero cost of capital. Since this decision only pertained to the compensation sections of the Railway Act(branch line abandonment and passenger subsidies), the accumulated deferred tax balances continue to be treated as equity capital for the other sections of the Act.

48. The most significant way the formula can be manipulated is through the flow of dividends from the railway to the parent in the calculation of the change in cash position. By altering the claimed dividend flow it is possible to affect the amount of debt assigned to the rail component.

49. In practice not all the 10 to 13 methods are considered.

50. It is interesting to note that, in 1980, the methodologies used by Snavely[137,pp146-150] yielded results ranging from 14.83% to 34.41%.

51. In 1980 an opportunity cost was calculated based on the return on the TSE 300. It was not used in any other year.

52. One of the most contested issues surrounds the appropriate cost of capital to be assigned to funds provided to the railways in the form of donations and grants. Included here are the original land, cash, and constructed rail lines given to the railways by the Government.

53. The treatment of deferred taxes and the effective tax rate was discussed in conjunction with the Income Tax case.

54. There has been some shift in pipeline regulation toward trended rate bases to alleviate the problems caused by inflation and the front end loading of rates. These new methods are still rate base-rate of return procedures with the only major difference being in the changing of the value of the base from one year to the next. It rises or stays constant as opposed to current procedures where it declines.

55. CN Rail uses CP Rail's variable investment coefficients for costing purposes.

56. Remember that the amount of equity is the residual after the value of bonds, preferred and preference shares are deducted from the reported net book value.

57. CP Rail does not have separately traded securities. Consequently the analysis had to be done on CP Ltd. Given the widely diversified nature of CP Ltd., the betas are not unexpected. The R^2 for these estimates were .734 and .735 for 1978 and 1979 respectively.

58. This observation depends on the industry being examined. A study be Vandell and Malernee[150] found, from a more aggregate analysis, that the betas for portfolios were widely scattered.

59. The risk free rate is not a source of serious problem. It is generally agreed to be the yield to maturity on government bonds. Some analysts make a downward allowance for the liquidity premium found in Canada Savings Bonds.

60. The problems of measuring risk were discussed in Chapter II.

61. See Fama and MacBeth[46,chapter 2] and Hagerman[61].

62. Much of CN Rail's equity was created by the recapitalization of debt. The most recent recapitalization being in 1978.

63. This situation is breaking down to some degree in such traditional monopolies as telephones where rapidly developing technology is resulting in increased competition.

64. Interline refers to the forwarding of traffic between connecting carriers. Railways also offer extensive intermodal services.

65. The railways argue that insufficient compensation for transporting grain was the major reason for these reported results. However, the following table shows the additional earnings which would be required for the railways to earn their cost of capital. It can be seen that the expected grain compensation is not sufficient to alter the observations made in the report.

ACTUAL REPORTED RETURNS AND ESTIMATED
RETURNS WITH COMPENSATORY GRAIN RATES
CP RAIL AND CN RAIL
1976 TO 1982

	CP RAIL		CN RAIL	
YEAR	ACTUAL %	ESTIMATE %	ACTUAL %	ESTIMATE* %
1976	4.67	7.59	2.55	5.77
1977	4.81	8.08	4.76	7.09
1978	5.17	8.88	5.48	10.16
1979	6.49	10.51	6.42	12.07
1980	7.76	11.88	7.20	13.23
1981	8.06	12.09	7.75	13.45
1982	7.35	11.30	2.67	8.22

* Since all costs have already been incurred, any subsidy would go to increase earnings before interest and taxes. Note that the computation for CN Rail assumes they continue in a non-taxable position.

66. Provision was made for abandonment of branch lines and the discontinuance of some passenger services.

CHAPTER V

FUNDS FLOW ANALYSIS

The preceding three chapters examined the cost of capital and fair rate of return concepts from both a theoretical and practical perspective. Although the theoretical understanding of the cost of capital and fair rate of return have progressed significantly in recent years, measurement problems persist. Techniques for estimating the cost of capital have become much more sophisticated but no one measurement technique has achieved general acceptance. As has been demonstrated, the various techniques yield a very wide range of estimates in any one year and any individual technique can yield very unstable results from year to year. It has also been demonstrated that some of the models are very sensitive to the data source and the temporal period used in constructing the estimates. It is due to these estimating problems that most regulatory jurisdictions employ a number of alternative techniques and rely on informed judgment to set the allowed rate of return, be it equal to or above the cost of capital[1].

In Chapter III it was pointed out that the rate base-rate of return formula represents the "state-of-the-art" approach to converting percentage rates of return into dollar amounts. This formula was used for public utility and railway regulation in the United States for almost fifty years before it was finally adopted into Canadian railway regulation. Even then, the abandonment of the requirements formula in favour of the rate base-rate of return was as much a matter of necessity as a decision to adopt a more contemporary measure. The major issue which delayed implementation of the rate base-rate of return approach and the issue which continues to cause problems is the valuation of the asset base. From the discussion in the previous chapters there are sufficient grounds from both a theoretical and practical perspective to necessitate caution when using the historic net book value as the rate base for quasi regulated companies, such as railways.

The funds flow analysis is a procedure which has been proposed for use in a situation where the asset base is believed to be valued below net book value. Generally speaking, the funds flow model is a more sophisticated version of the requirements formula previously used by the Board of Transport Commissioners. The funds flow analysis was first proposed and subsequently rejected as an alternative to the rate base-rate of return formula during the 1969 Railway Costing Review. In 1976 the United States Interstate Commerce Commission (I.C.C.) adopted a funds flow model as one of the financial measures to be used in its revenue adequacy proceedings[71]. However, the model was only used for one year before it was made obsolete by the passage of the Staggers Rail Act of 1980[160].

The purpose of this chapter is to describe the funds flow model and demonstrate its relevance to Canadian railway regulation. Since the primary motivation for using the funds flow model arises out of difficulties in accepting net book value as an asset base, this provides a logical starting point. The emphasis in this section is to develop an understanding of the relationship of the book and market values of the firm. Using a simple model for valuation of a firm the theoretical basis on which the model is constructed is presented. The model is then described along with the major assumptions necessary to operationalize it. The detailed description of the model and the results it produces are not discussed until the next chapter.

Since the model has only been used by the Interstate Commerce Commission, the United States experience is reviewed in this chapter. The focus is on why the funds flow model was adopted, what its purpose was and how it was used. To illustrate, some of the results of the funds flow model are compared to rate base-rate of return results for the one year when both models were employed.

1. VALUATION OF THE ASSET BASE

Ideally, the market value of the firm should be used as the asset base in the rate base-rate of return formula. However, for numerous reasons it is rarely used in regulatory applications. The major reasons for this were elaborated on in Chapter III and are summarized below:

a. The difficulty in measuring the market value especially when the entity does not have its own capital structure.

b. The possibility of circularity wherein the fair value of the firm is the end product of the regulatory decision on the allowed rate of return.

c. The difficulty in measuring the rate of return in real terms or in other ways eliminating the double counting of inflation.

Net book value is used almost universally as the asset base. It is attractive because it can be traced in the accounting records of the regulated firm. Also, it can be argued that the value of an asset when it is added to or retired from the books represents its fair market value. The difficulty is that railway assets are typically long lived and during the time between these two entries the market and book values are unlikely to correspond.

In the case of companies, such as public utilities, where all rates are regulated, it is possible to assume that the net book value is a proxy for the market value of the firm. Such an equality ensures the maintenance of the financial capital of the investors in the regulated entity. It does not mean that the market valuation of the company's assets, were it unregulated, would be equal to net book value. This latter point can be clarified through the use of some illustrations. In many cases public utilities are regulated to prevent them from earning monopoly profits. Here, in the absence of regulation, the market value of the firm would most likely be greater than its book value thus generating "windfall" capital gains to the owners. By using the book value it is possible to eliminate the "windfall" and approximate the results of a competitive market place. In other situations, regulated utilities are required to provide service to all users in an geographic area. Therefore, to induce investors to provide service, they are often assured of a return on their investment. Both these examples illustrate that the use of the net book value is closely tied to the maintenance of financial capital and the desire to obtain price levels similar to those which would be expected in a competitive market place.

These examples also illustrate why public utilities regulation focuses on the return the regulated enterprises will be allowed to earn. Issues concerning the asset base valuation understandably emphasize what assets should go in the asset base. Often the assets removed from the rate base are deemed to be neither used or useful. In these cases the net book value of these assets is removed from the rate base.

The regulation of Canadian railways can be described as being somewhere between public utilities and unregulated companies[2]. Therefore, before moving to the railway case it is useful to consider the relevance of the net book value measure to an unregulated firm. In short, with imperfect competition, it is only by accident that the market value will equal the net book value of a firm. All other things being equal[3], the profitable[4] firms will have market values equal to or greater than net book value while unprofitable firms will have market values less than net book value. The extreme case of the unprofitable firms will be those firms whose market value is equal to salvage or scrap value.

The Canadian railways are only partially regulated. Moreover, the purpose of the regulation is not to control the railways' overall rates of return. Rather, it is designed to compensate the carriers for undertaking uneconomic services and, under very restrictive conditions, limit the rates which can be charged on specific services[5]. For the most part, the railways are free to price their services and to maximize their profits. Therefore, the presumption that the net book value is a proxy for the market value of the assets in the rate base rate of return formula, is made under a very different set of circumstances than for public utilities. In order to determine whether this presumption is justified, it is necessary to look first at the economic conditions which result in the convergence of market and book value.

There are three conditions where market value and book value converge; when there is perfect competition, when the company's revenues are determined using a rate base-rate of return formula, and when the present value of expected future earnings happens to equal net book value. Neither of the first two conditions apply to Canadian railways. They are oligopolies with the ability to collude in pricing their services[6] subject to some limited regulatory restrictions. This in itself is not sufficient grounds to conclude that the net book value is greatly different from market value. The latter condition is in reality a statement of the conditions necessary for the coincidental equating of the book and market values. In imperfect markets, there is no reason to expect the market value of the firm in long run equilibrium to trend toward net book value.

In order to explore the potential error resulting from the use of the net book value it is useful to use one of the models for valuation of the firm. These models focus on the right hand side of the balance sheet. By assuming the market value of the assets is equal to the market value of the firm's securities it is possible to indirectly measure the market value of the assets. The financial market value of the firm is the sum of the values of the financial securities that have been used to finance the assets purchased[84,Ch II,pp25]. To keep this illustration simple, it will be assumed that the assets are financed entirely with equity. Thus the value of the firm is equal to the market value of the common shares.

The basic concept of common stock valuation is that share values depend on returns expected by investors with the probability of these expectations reflected in the capitalization rate[90,pp366]. There are numerous approaches to measuring investor expectations, however only four theories are widely accepted. These are[92,pp366]:

1) The stream of earnings approach,
2) The current earnings plus future opportunities approach,
3) The stream of dividends approach, and
4) The discounted cash flow approach.

Mao[92,pp464-477] demonstrates that under conditions of certainty[7], rationality[8], and perfect capital markets[9] the four approaches are mathematically equivalent. For purposes of this discussion and for future presentation of the funds flow model, the investment opportunities approach will be used.

According to the investment opportunities approach, share value is equated with the present value of net earnings from existing assets plus the present value of the net earnings from the firm's future investment opportunities. In mathematical terms this approach can be expressed as follows[90,pp368]:

$$V_1=X_1/k+\sum_{t=1}^{\infty}[I_t/(1+k)^t][(r-k)/k] \qquad (5\text{-}1)$$

where:

V_1 = Total value of a firm's shares at the beginning of period 1
X_1 = Earnings from existing assets during period 1, which for simplicity are assuned to be received at the end of period 1. Theses earnings are assumed to remain constant.
k = Required rate of return (risk-free rate or risk-adjusted rate)
r = Return on future investments
I_t = Net additional investments in period t, which for simplicity are assumed to occur at the end of year t.

Using equation (5-1) as a basis the conditions necessary for market value to equal net book value of the assets can now be explored. As a starting point consider the public utility case where the regulator sets the allowed rate of return equal to the marginal cost of capital $(r-k)^{10}$. Equation (5-1) is then reduced to equation (5-2).

$$V_1=X_1/k \qquad (5\text{-}2)$$

The rate base rate of return allows the regulated entity to set revenues at a level which cover operating expenses including depreciation plus a return on net investment. Therefore, the earnings (X_1) are the sum of the depreciation and the return on investment. When this is discounted over the life of the asset it can be shown that (V_1) equals the net book value.

Consider for instance, an asset which was purchased for \$100 a year ago. If this asset has a four year life and depreciation is computed using a straight line method, then the net book value in year two is \$75. Using a rate base-rate of return formula with an allowed rate of return of 10 per cent, the earnings in year two would be \$7.50(=75 x .10). Using formula (5-2), the market value of the company would be \$75(=7.50/.1). This illustrates one of the conditions necessary for market and book values to be equal.

In imperfect markets the return on future investments (r) can be greater than the cost of equity capital (k). Referring to equation (5-1) it can be seen that a firm which is earning a return on existing assets at least equal that allowed under a rate base-rate of return computation and has future investment opportunities with a potential return (r) greater than the cost of equity capital (k), will have a market value greater than book value. Also, depending on the difference between (r) and (k), it is possible for a company reporting earnings (X_1) below those expected using a rate base-rate of return standard to have a market value less than, equal to, or greater than the market value.

Since neither railway is a separate entity with publicly traded securities, it is not possible to directly observe the market value of the firm. However, it is possible to determine what the market value of the firm would likely be relative to reported net book value. One way of doing this is to simply compare the reported earnings before interest and taxes to a weighted average cost of capital determined by the CTC[11]. Table IV-4 in the previous chapter contains such a comparison for the years 1977 to 1982. It is immediately obvious that reported returns on net book investment are significantly below returns required by the market place. Thus, if market and book values are to be equivalent there must be a very large difference between (r) and (k) or (X_1) must be at a low level due to extraordinary reasons or some combination of the above. During the time period presented in the table the railways were not receiving adequate compensation for the movement of statutory grain[12]. As can be seen, even when the reported earnings are adjusted upward to account for the grain revenue short fall, the expected rate of return (r) must still be much greater than the cost of capital in order for the market value to be anywhere close to net book value.

There have been a number of reasons offered for why the market value of railway assets are below the net book values. The majority of this discussion has been conducted in the United States where much of the regulation is closely tied to measures of revenue adequacy[71][72][73][14]. This issue has also been discussed in Canada but to a much lesser extent[112][113]. While the discussions usually focus on the reasons for the low reported returns on net book value found for almost all North American railways, the reasons offer considerable insight into why the reported net book value is an overstatement of the market value of the assets. The major points raised focus on the excess capacity which is characteristic of the industry. Some of the causes of the excess are summarized below:

a. The presence of inert assets in the asset base. These include assets which are no longer used or do not contribute to the productive efforts of the company (e.g. a statute).

b. Under-utilized capacity. In many areas served by the railways[13] there is excess capacity relative to current traffic needs. This is a result of the combined affects of a system which was over built in the first place with regulatory resistance to rationalization. The situation is compounded by the tendency of the railways to duplicate infrastructure on some routes.

c. Loss in earning power. In the 1940's and 1950's there was a shift of large volumes of high value traffic to the subsidized highway mode. During this period and continuing on into the 1980's, the structure of industry and its location also shifted. As a result, many rail lines which once served thriving areas have seen the traffic offered decline significantly. Where demand drops to zero, such as is the case when the only shipper on a line no longer requires rail service, the asset is no longer required and its only value is as salvage. There is also the situation where demand drops but not to the point that the earning value of the asset(measured by the present value of its cash flows) is below the net salvage value. When the economic value of the asset is between net salvage and net book value there is no write down of the asset due to the group depreciation procedures used by the railways[14]. Excess capacity created in this fashion is much more likely to occur with railways than public utilities.

d) Obsolete technology and design. Railway assets have very long service lives. Therefore, it is not surprising that some assets become redundant due to technological change. The introduction of new specialized rolling stock has made the box car almost obsolete. Similarly, designs of some facilities have become inefficient as a result of changing operating procedures. An example is the problem arising from the operation of one hundred car trains into yard facilities designed for twenty-five to fifty cars. This situation is compounded by the railways' depreciation accounting. They use deprecation rates based on the estimated physical life of the asset rather than its economic life.

e) Investments are "lumpy". Additions to railway infrastructure tend to add large increments of capacity. The decision to double track a particular section of track will more than double capacity. Investments such as the Mount MacDonald tunnel will accommodate CP Rails capacity needs well in the future[15].

f. Regulatory constraints. In some instances regulation or other forms of government intervention constrain the ability of railway management to efficiently utilize their investments to maximize profits. The examples of this most often cited are in the grain handling and transportation system. Here regulation and government institutions combine to control all the key aspects of the distribution system.

g. Accounting practices. The Railways have to use depreciation rates set by the CTC[16].

The preceding arguments present only one side of the argument. Taken alone these arguments would lead to the conclusion that the asset base is grossly over-valued. There are three salient arguments which would lead to the opposite conclusion at least for some railway assets.

a. Betterment accounting. In the previous chapter it was pointed out that the railways use a form of betterment accounting. As a result, net asset values reflect the original cost of labour and the latest value for materials used in a replacement program. This will cause an understatement of the net asset value[17].

b. Marketable assets. There is a market for many railway assets such as locomotives, cars, and equipment. Consequently, they can be sold at any time or leased into alternate services[18].

c) Profitable investments. The railways have over the years employed assets into some very profitable services. The unit coal trains are excellent examples of this.

Despite these latter arguments the preponderance of the evidence points to the conclusion that the market value is less than the book value.

One other line of argument in favour of using the net book value needs to be explored. In the case of public utilities the net book value is used to simulate a competitive situation and to ensure investors are treated fairly. With one notable exception which will be considered a bit later, these arguments do not apply to the regulation of the railways. In the case of subsidized services, the decision to require the railways to continue to operate the service at public expense, be it a branch line, passenger service or grain traffic, was made after the railways had decided to disinvest in the service. Under these conditions, basing compensation on the net book value is to overstate costs. Paying the railways a rate of return based on the salvage value (market value) of the assets would have kept them whole and indifferent between the decision to continue or discontinue the service. Once they are required to maintain a service they must be allowed to earn a return based on the net book value of any asset purchased in order to sustain the service. Obviously, not to do so would result in the investor not supplying the necessary capital[19]. This latter situation is analogous to the public utility case where the utility is required to service unprofitable areas.

The above argument over simplifies the reality of the situation but the point made is still valid. If all the assets employed were directly traceable to the service being subsidized, then the scrap value would constitute the proper asset base for rate of return compensation. The reality of the situation is that most of the assets used are common with a number of services. Nevertheless, this does not justify the assumption that the market and book values of the assets employed are equal.

The other aspects of railway regulation are the rate regulation provisions: minimum rates, maximum rates, and the public interest rate appeal mechanism. Again, these provisions should not be confused with the public utility case. The purpose of these regulations is to set reasonable bounds on railway rates, not to control the overall return earned by the railway. Under the provisions of the legislation the railways are free to price their services and maximize profits. They could legally earn economic profits provided all the rates they charged were above variable costs, below the maximum and not found to be detrimental to the public interest[20]. Therefore, the market value of the railway assets could be above or below net book value. It would only be an coincidence that the two would be equal.

The preceding discussion has explored in considerable detail the relationship between book and market values. Even though these are obvious problems with the use of net book value as the asset base, there is only limited opportunity to avoid the difficulties by using a market valued asset base. With exception of the cases where scrap value is the appropriate value or where assets are traded in an active market, the market values of railway assets are very difficult to measure. Also, wherever market values are used in conjunction with a regulatory framework, the circularity cannot be eliminated except in those cases where there is a market for the company's assets that includes non-regulated firms.

In summary, it appears that neither the market nor the book value are totally acceptable. However, based only on circumstantial evidence it does appear that the use of the net book value as the asset base in the rate base rate of return formula will yield cash flows to railway investors greater than they should have been[21]. It also appears that there is no feasible way of obtaining an unbiased estimate of the value of the asset base. It is for these reasons Ezra Soloman[138,pp65] observed that:

> The rate of return on invested capital is a widely used concept in both regulated and unregulated sectors of the economy. It provides a measure of actual performance as well as required or expected performance (the latter is often termed the "cost of capital"). In the utility field, regulatory agencies often focus on the rate of return as a major instrument for assessing and controlling the performance of firms under their jurisdiction. Unfortunately, two altogether distinct units are employed for measuring rate of return: (1) book rate units and (2) discounted cash flow units. Rarely will the two produce the same result, and the use of one measure as a surrogate for the other may prove highly misleading.

2. FUNDS FLOW ANALYSIS

The funds flow model was originally conceived as a measure of the required rate of return which is independent of the asset based used and is based on the concept of maintaining the financial capital of the investors. The model does this by measuring the cash flows expected by investors in a given year from existing and planned investments. This is done through the construction of a pro forma source and uses of funds statement which is then analyzed relative to various alternative financial criteria for measuring revenue adequacy.

Probably the most significant feature of the funds flow model is that it estimates the required return[22] on investment as a dollar amount rather than as a percentage. This has very important implications for the regulation of railways. Assume for a moment that the funds flow method does generate an accurate estimate of investors' expectations. It is no longer necessary to be concerned about the proper valuation of the asset base. If market value was used the quotient of the cash flow estimate divided by the market value would be in line with rates of return (costs of capital) observed in the market place for securities of similar risk. On the other hand, the resulting quotient of the cash flow estimate divided by the book value would be in line with the reported rates of return. Because the focus is on the cash flow estimate either measure of the asset base can be used for cost allocation. Thus, the current costing procedures which compute variability based on net book values could continue[23].

The theoretical rationale behind the fund flow model is found in the valuation of the firm. Consider first a simple valuation model discussed earlier in this chapter. Where the expected rate of return (r) was assumed to be equal to the cost of capital rate (k), equation

(5-1) was collapsed to equation (5-2)[24].

$$V_1=X_1/k \qquad (5\text{-}2)$$

The funds flow model attempts to estimate the expected cash flows (X_1) from the company's investments. These earnings are then discounted by the market place at a rate k which reflects risk of the investment. The result is the market value of the firm. As was discussed in Chapter II, the discount rate used (k) represents investors' collective expectations of future earnings and their collective assessment of the risks inherent in these expected future earnings.

There is an important difference between the funds flow model and the various models reviewed in Chapter II. The more commonly used market models estimate the cost of capital by observing and analyzing the market price of the securities and in some cases the cash flows, be they earnings or dividends. The resulting relationships are then extrapolated into the time period under analysis. In other words, a cost of capital rate is estimated based on past experience which is assumed to remain unchanged for the duration of the period under analysis. Therefore, to obtain the cost of capital in dollar equivalents the cost of capital rate must be multiplied by an investment value. The funds flow model, in contrast, attempts to estimate the subsequent years' earnings directly through the construction of proforma cash flow statements. This is based on the proposition that investors concern themselves primarily with the future earnings prospects of the firm. These prospective earnings are then discounted at a rate which takes into consideration the risk of the firm. The result is the market value of the security. To reiterate, the critical difference with the funds flow model is that it starts with the expected return to investors rather than solving for it.

2.1. FUNDS FLOW MODEL AND REVENUE ADEQUACY

The funds flow model is based on one other critical presumption about investors expectations. Very simply stated, it is assumed investors do not acquire a security with the expectation of losing money[25]. Restated in terms of concepts already discussed in this paper, investors expect to maintain the integrity of their financial capital. Debt holders expect to receive the coupon rate of interest and repayment of their principle at the end of the life of the debt issue. For the common equity holder to maintain his financial position he must realize his expected dividend stream and/or capital gains over the period he holds shares. Like the dividend growth model it is argued that the sale of the security is a transfer of the rights to the future income stream. Therefore, when it is assumed that investors do not expect to lose money, it logically follows that investors who acquire a security do not, barring stock splits, expect stock prices to decline.

The source of the returns to both the debt and equity investor flow from the company's income stream. In order for the company's investors to maintain their financial integrity, the earnings generated by existing assets must, at the minimum, remain constant in real terms. If new investments are to be undertaken, using retained earnings or new equity, the stockholder should expect, at the minimum, a return equal to the marginal cost of equity capital. Similarly, if the company raises new debt to finance a new asset, the investment must be expected to earn a return at least equal to the marginal cost of debt. When the two sources of capital are combined for purposes of making investment decisions, the investor expects a return equal to the weighted average cost of capital.

The minimum conditions expressed above for maintenance of financial capital[26] are often expressed in terms of revenue adequacy standards. These standards have been the object of an on-going debate in U.S. railway regulation where they play an important role[27]. The definition of revenue adequacy which is used for regulatory purposes in the U.S. is described by Borts[14,pp8] as follows:

> Railroad revenue is considered to be adequate when it provides sufficient funds beyond out of pocket expenses for the adequate maintenance of rail plant, for the payment of interest, dividends, and taxes, and for the retention of earnings. Moreover such revenues must be sufficient to attract new capital in the magnitudes necessary to expand physical plant and serve traffic requirements efficiently and expeditiously.

Notice that the definition concerns itself with what revenues should be as opposed to what they will be.

The funds flow model proposed here, like the U.S. model, uses a measure of required revenue necessary to meet investors' expectations rather than a forecast of the next year's earnings. As a result, the model produces a target to which management must aspire if they are to act in the investors' best interest. Failure to achieve this target will result in investors discounting the price of the company's securities. Conversely, exceeding the target will result in an appreciation of the stock price[28]. It is for these reasons that Leland[87,pp7] defines a fair rate of return to capital as, "a pattern of profits across states of nature just sufficient to attract capital to its present use, which is equivalent to the stock market value of the firm, equally the market value of the firms assets".

Based on the foregoing discussion it can be argued that, if the security values are in a state of market equilibrium , expectations of future earnings are equal to a level which would result in the maintenance of the financial integrity of the various investors in the firm. Furthermore, if a measure of revenue adequacy can be found which approximates the conditions necessary to maintain the financial capital of the firm under conditions of perfect competition[29], then the funds flow analysis can generate directly an estimate of expected earnings consistent with equation (5-2).

In order to describe the funds flow model it is necessary to explain in more detail how revenue adequacy can be measured. The minimum condition has already been specified in terms of what is required to maintain the financial capital of the investor. To reiterate they are:

a. For the debt holder, payment of the annual coupon rate of interest and repayment of the principle when due.
b. For the preferred or preference stock holder, payment of the annual dividend.
c. For the equity holder a level of earnings through dividends or capital gains equal to the opportunity cost of capital.

Since it is necessary for the investor in preferred or common stock to sell his investment in order to recoup the initial capital outlay it is necessary to assume that an investor can buy or sell these securities at any time[30]. He is, therefore, constantly re-evaluating the cash flows being generated in relation to the market value of the security[31]. The collective decisions of investors to buy or sell will cause the market value of the securities to change. For those investors whose expectations are borne out by future events, financial capital will be maintained. Therefore, for the preferred shareholder the key element in maintaining financial capital is the expected dividend level.

Common equity is not as straight forward. Maintaining financial capital of equity investors must be examined in two parts, the return on existing and on new investments. Both of these must be considered in order to take into account the capital gains component of the investors' expected return. Consider first a single product firm which does not require any capital investments to sustain production. Under these conditions it can be further assumed that the firm's assets are yielding a positive cash flow stream to the investors which is all paid out as dividends. If this stream is not expected to grow, then the market value of the security can be expressed as:

$$V_1=X_1/k \qquad (5\text{-}3)$$

To be revenue adequate the firm must earn what investors are expecting as earnings (X_1) in the subsequent period. Since it is not possible to read the mind of the investor, a proxy must be used. This is constructed by developing a minimum condition for revenue adequacy. It was previously stated that investors do not buy a security to lose money. Therefore, the firm must earn at least as much in the forecast period (year 1) as it did in the base period (year 0). It is on this basis that a very important assumption in the funds flow model is built. The model assumes that the current earning power of the company's assets is the minimum real level of earnings expected by investors in the subsequent period[32]. When constructing the model it is therefore possible to take the prior year's earnings and adjust them for expected inflation. The inflation adjustment is necessary to preserve the real earning power of the funds invested.

The second aspect of maintaining the financial capital of the equity investors concerns new investments. In the normal course of business, funds are allocated to replacing worn out assets or buying new assets. Assume each investment is evaluated[33] and undertaken only if it has a return equal to or greater than the cost of capital to the firm. Again it is not possible to simulate the expected earnings stream for the new investments. However, it is possible to state another minimum condition necessary to maintain the financial capital of the investors. These new investments must earn at least the marginal cost of capital. Where the project is financed by both debt and equity, it must earn at least the weighted average marginal cost of capital[34]. Therefore, to be adequate, revenues for the subsequent period must yield an earnings stream at least equal to the marginal cost of capital. As an aside, it should be kept in mind that under conditions of perfect competition there would be no justification for the earnings to exceed the marginal cost of capital.

This section has examined the conditions of revenue adequacy which underlie the funds flow model. These conditions have been based on the minimum earnings necessary to maintain the financial capital of the investors. The manner in which these conditions are incorporated into the model is discussed later in this chapter.

2.2. FUNDS FLOW ANALYSIS AND FAIR RATE OF RETURN CRITERIA

The funds flow model on which this paper is based was developed for use by the Interstate Commerce Commission. Therefore, it had to take into consideration the various factors both legal and economic which influence the determination of a fair rate of return.

It is quite clear that, from a regulatory perspective, the primary emphasis of the funds flow model is toward the maintenance of the financial integrity of the railway investor. In the development of the model it was never explicitly stated whether the model was designed to maintain financial or physical capital. However, it is quite clear that the model is designed to maintain the financial capital of debt and equity investors.

Although the model is designed to produce an estimate of the minimum revenue required, there is no reason why a regulator could not adjust this figure upward to accomplish other objectives[35]. In fact when the model was used by the I.C.C., they did acknowledge having made an upward adjustment but did not state their motives for doing so[73,pp245]. The potential for using the funds flow model as a tool in rate of return determination was acknowledged during the hearings before the Interstate Commerce Commission leading to the acceptance of the funds flow model. At the hearings, Dr. George Borts[14,pp16], one of the main proponents of the funds flow model, argued that:

> The cash flow method inquires into the funds which must be earned by the railway to keep it a going and ever expanding concern, and to keep faith with its creditors and stockholders in the sense of making the cash payments necessary to meet its financial obligations.

Now that the various factors and assumptions which form the basis for the model have been laid out, the mechanics of the model can be described in more detail.

2.3. ANATOMY OF THE FUNDS FLOW MODEL

The funds flow or cash flow model as it is sometimes referred to in the United States, was developed as a direct measure of railways' required rates of return. In Ex Parte[36] 338[72,pp26], the Interstate Commerce Commission described the cash flow or funds flow approach to capital costing as follows:

> It was the desire to find a direct means for measuring revenue need that prompted the development of the funds

> flow model in Ex Parte No.271. The procedure embodied in this model is to project the needed capital outlays and other fund requirements of the railroads, to determine the amount of funds available to them from operations and capital sources, and to ascertain the amount by which the available funds would fall short of the project requirements. The dollar amount of this shortfall is added to the projected revenue level to find the amount of revenue needed. For ease of application, this revenue amount can be translated into a percentage return on net investment.

The basic framework is a source and uses of funds statement. This is used to identify the earnings level necessary to meet various criteria of revenue adequacy. These criteria are based on the discussion in the previous section and are stated below:

a. Return required to maintain the return on existing investment at the previous years level and to make new investment profitable.

b. Return required to provide adequate fixed charge coverage.

c. Return required to provide required equity capital from retained earnings.

The first criterion reflects the earnings required to maintain the financial capital of the debt and equity investors. This criteria reflects the main thrust of the funds flow model and is the one of primary interest in this paper. Two additional criteria have to be incorporated into the model to capture alternative measures of revenue adequacy which are relevant to the railway industry. The second criterion is also a measure of financial integrity. To be adequate it is argued that revenues must be sufficient to maintain the company's credit rating. The measure used in the funds flow model is the debt coverage ratio. The third criterion reflects the fact that most railways are relying on internally generated funds to provide equity financing for new capital projects. Under this criteria, earnings must be sufficient to provide the required amount of equity capital without having to issue new common stock. As the U.S. experience with the model is analyzed in the next section, the rationale for these criteria will become much clearer.

In constructing a funds flow model it is necessary to make a number of assumptions. The preceding discussion laying out the basis of the funds flow model has indicated the types of assumptions which are necessary to construct the funds flow model. They are restated below with a brief discussion of their relevance and importance.

a. Capital Markets are Efficient:

This generally accepted assumption[37] says that security prices fully and instantaneously reflect all available relevant information. The model assumes that all relevant information is transposed into earnings expectations. Thus, the market valuation models can be used which focus on earnings. With efficient capital markets it can be further assumed that investors have homogeneous expectations of future earnings and assessments of the risk of these earnings.

b. Investors seek to maintain their financial capital:

Stated differently, investors expect at the minimum to recoup their investment and earn a return on the funds invested. Naturally, investors would like to earn more than they expected. However, if capital markets are efficient, the excess earnings would be bid away by new investors purchasing the company's securities.

c. Earnings generated from the company's existing assets are being maximized:

In Chapter IV it was pointed out that Canadian railways were largely deregulated in 1967. They were given the freedom to set rates subject only to very limited restrictions. Also, under the Act they are compensated for services retained in the public interest. Therefore, it appears reasonable to assume that railway management is maximizing the earnings in any given year[38]. This is the basis for projecting the current period earnings into the subsequent period. One significant difficulty with this assumption must be considered. It was not until December of 1983 that the railways received compensatory revenues for the movement of Statutory grain. Therefore, in any prior period the ability of management to maximize earnings was constrained. If during this period investors only expected earnings from grain at the Statutory level, then it could be argued that no adjustment is necessary because the market value of the railway security would have incorporated this expectation. The problem is that during the period of analysis chosen for this study revisions to the statutory grain rates were being actively considered by the Federal Government[39]. Therefore, investors would have attached some probability to obtaining additional revenues in any of these years. It is for this reason that the analysis in the next chapter examines the impacts of the compensatory grain revenues on the computations.

d. New investments earn their cost of capital:

This assumption is critical to use of a one period model such as the funds flow. If the rate of return on new investments were to exceed the cost of capital the simplified valuation model expressed as equation (5-2) would be invalid and the more complex multiperiod model expressed by equation (5-1) would have to be used. Even though the marginal investments being undertaken by the railways are likely to be earning a return greater than the cost of capital[40], it is not necessary that the rate of return be greater than the cost of capital in order to maintain financial capital. The model is designed to measure the minimum conditions for revenue adequacy. Therefore, the cost of capital should be used rather than the rate of return[41].

e. Risk remains constant:

It is assumed that new investments do not alter the risk of the firm.

These are the main assumptions necessary to construct the model. There are many other assumptions which pertain to the computations of the various elements of the model. For instance the model requires an estimate of the current cost of capital. Depending on which model is used, additional assumptions are required. These assumptions have already been considered in Chapter II.

In its conceptual form the model is straight forward. It can be described as a series of steps which lead to the three measures of revenue adequacy given above. Since the details of the model will be presented in the next chapter and its related appendices, only the framework will be presented here. In order to follow the logic of the model it is important to remember that the base year is year 0 and the estimates are being constructed for the forecast period, year 1. For the most part the model is similar to the steps required to construct a pro forma source and application of funds statement. The nine steps in the model are described below.

a. Estimate Sources of Funds:

> Other than net income, which the model solves for, the normal sources of funds to a railway are depreciation and deferred taxes. In addition, some funds are generated from the sale of property and salvaged materials.

b. Estimate Application of Funds:

> Other than Plant and Equipment: Except for capital investments the major uses of funds are dividends for preferred and common stock. As will be seen below, there is no provision for repayment of debt as a use of funds. This is because the model assumes that all debt is rolled over.

c. Forecast of Capital Requirements:

> Railways require new capital to replace worn out assets and to expand their plant.

d. Financing of Capital Additions:

The cost of capital assets purchased in excess of the funds available after deducting the non-capital uses (Step 1 minus Step 2) must be externally financed. It is assumed that new capital is raised in the same proportions as the target debt to equity ratio.

e. Computation of the Cost of Debt and Preferred Stock Financing:

This part of the computation estimates the fixed charges for the forecast period. Included in the fixed charges are interest payments on existing debt and any new debt issued to finance capital expenditures. Also, where appropriate, consideration must be given to preferred and preference shares[42].

f. Computation of the Earnings Required to Provide a Return on Existing Investment at the base year level and to Make New Investments Profitable (Criteria I):

Existing assets are assumed to earn the same level of earnings as they did in the base year. The portion of new assets financed by equity are assumed to earn the market cost of equity.

g. Computation of the Earnings Required to Provide Adequate Fixed Charge Coverage (Criteria II):

Based on industry standards a target coverage ratio is determined. This is then used to compute the level of after tax net income which would be consistent with the target coverage ratio.

h. Computation of the Earnings Required to Provide Required Equity Capital from Retained Earnings (Criteria III):

Earnings must be sufficient not only to finance new capital but also to pay the dividends.

i. Conversion to Required Returns on Net Book Value:

Each of estimates of the required earnings levels to meet the three criteria of revenue adequacy are converted to percentage returns on net book value.

The last step may appear as a surprise in view of the problems identified with the use of the net book value as an asset base. Because the required returns are converted to the conventional percentage return at the end of the computation the problems are minimized. The returns are independent of the asset base. Ideally, the market value of the assets should be used to compute the percentage. However, for cost analysis purposes, the net book value offers the only practical basis for allocating capital costs to specific services. In Chapter IV the costing process was described in some detail. There it was pointed out that the railways use regression analysis to develop a relationship between the investment levels and railway output (gross ton miles)[43]. The rate of return is applied to the variable portion of the asset base to get the required rate of return. Thus the percentage returns determined by the funds flow analysis can be substituted for the current approved cost of capital rate. At this time there are no feasible substitutes for the net book value for the assignment of costs[44].

There is one other aspect of the funds flow model which is not incorporated into the above description. It has to do with the situation which could arise if the funds flow model were to yield a return for a regulated industry[45] greater than that from the conventional rate base rate of return. This is a hypothetical situation not likely to arise in this case. Nevertheless, it raises an interesting point. Given the manner in which the model is constructed the only way this could occur would be in a situation where earnings from existing assets are higher than required by the rate base rate of return formula[46]. If this is the case, then it can be argued that the company is earning excess profit. To be revenue adequate they would only require earnings at the level identified by the rate base rate of return formula. Such a level would be consistent with what would be expected in a competitive environment[47]. It is for this reason that, for a regulated industry, the return generated by the rate base rate of return formula must be the ceiling. Otherwise excess profits would be included in the allowed return on investment. Considered from a different perspective, the market value of the assets should not be allowed to exceed the net book value. It is when market value is believed to be below book value that the funds flow model provides the regulator with a useful insight into the required rate of return. This was the situation in the United States which lead to the Interstate Commerce Commission to develop and use the funds flow model in railway regulation.

3. FUNDS FLOW MODEL - THE U.S. EXPERIENCE

So far in this chapter the discussion has focused on the rationale behind the funds flow model, the assumptions necessary to use it and a conceptual outline of the model. Now, by examining the U.S. experience with the funds flow model, the conditions where it was intended to be used can be better understood.

In the late 1960's and early 1970's U.S. railroads were in a state of decline and transition with many of them bankrupt or on the verge of bankruptcy. Other railways were deferring maintenance and labouring under large amounts of underutilized capacity[14,pp8]. This situation led to repeated criticisms by intervenors against general rate increases that the net investment base was excessive as a measure of the need for additional revenues. In addition, there was concern with the railroads general financial condition. In response to this situation the I.C.C. instituted a proceeding (Ex Part 271) in 1970 to determine whether the net book value rate base used by the Commission for calculating the rate of return was valid or whether some other measures should be utilized to judge the financial condition of the railroad industry[71,pp1495].

As part of the Ex Parte 271 study of the rate base, the I.C.C. examined the return on net investment reported by the railways as compared to the return which would be expected if the fair return on the rate base standard were used. They found the reported returns to be substantially lower than the standard. In addition, the I.C.C. estimated the additional revenue required to achieve the earnings level computed by the fair return on rate base standard. The I.C.C. findings can be best illustrated by considering the results for the western district[48] for 1976[71,pp1563]. In this year the western district railroads reported a 4.9% return on net investment. The I.C.C. in their report said a 6 to 10 per cent return on net investment would be fair. For the western railroads to achieve an 8 per cent return a 13.2 per cent rate increase would be required. Considering modal competition and traffic attrition due to the higher rates such an increase was considered unachievable. This led the I.C.C. to conclude that[71,pp1498]:

> Since revenues required by the implementation of a fair return on rate base standard, as used in the regulation of public utilities, cannot be obtained, it would be

> futile, indeed, for the Commission to rely upon it exclusively as the test of reasonableness. Rather, its role in railroad general revenue proceedings as just one financial indicia of revenue need...should be maintained[49]...
>
> ...In evaluating the railroads' revenue needs, the Commission had held that rate of return on net investment is a significant but not exclusive measure of the financial health of the industry and has thus given weight to other financial indicators. The Commission has repeatedly rejected the argument that a return on rate base judged fair or not unreasonably high is necessarily a valid measure of just and reasonable rate levels. Thus, while the return on capital invested may be judged substandard or inadequate when compared to the earnings experience of other industries, or to the interest costs of new financing, a higher level of rates necessary to produce higher earnings may be found to be unjust or unreasonable. On the other hand, the Commission has held that a rate of return determined to be substandard is at least an indication that the underlying rate level is within the zone of reasonableness.

Early in the Ex Parte 217 proceeding, which ran from 1970 to 1976, the use of funds flow analysis was acknowledged as one of the tests of revenue adequacy. During the proceeding the critical question was not one concerning the conceptual validity of funds flow analysis but rather one concerning the practicality of implementing the analytical methodology and resolving all the mechanical problems associated with the model[71,pp1573]. While not advocating the strict use of funds flow analysis, even the railroads saw merit in the concept in so far as it focused on the industry's present and ongoing needs for capital and on the level of earnings required to meet future demands for rail service. After satisfying itself that a funds flow model could be constructed and that it would be a useful addition to its decision making tools, the following decision was made by the ICC[71,pp1495]:

> The Commission adopt funds flow methodology to evaluate railroad revenue need in general rate increase proceedings and otherwise assist it in discharging its responsibilities under the Interstate Commerce Act.

In constructing the funds flow model the ICC focused on "what should be" and not on "what will be". The ICC was concerned with determining the earning levels the railways should achieve in order to stop the erosion of the physical plant and service levels. To base the funds flow estimates on the "what would be" scenario would result in future capital spending being constrained by the projected income flows. This would have understated the railways' capital needs and resulted in further deterioration of the physical plant. From its onset the model was designed to compute the minimum adequate earnings level necessary for the railways to sustain themselves and meet the needs of new customers.

One of the major thrusts of the Railroad Revitalization and Regulatory Reform Act of 1976[159], more commonly known as the 4 R Act was to assist rail carriers in achieving adequate revenues. Obviously such an objective requires the specification of what is considered adequate revenue levels. In this regard, Section 205 of the 4 R Act required the Commission to:

> develop and promulgate (and thereafter revise and maintain) reasonable standards and procedures for the establishment of revenue levels adequate under honest, economical, and efficient management to cover total operating expenses, including depreciation and obsolescence, plus a fair, reasonable, and economic profit or return (or both) on capital employed in the business.

Section 205 continues to provide additional guidance concerning the revenue levels stating they should

> a) provide a flow of net income plus depreciation adequate to support prudent capital outlays, assure the repayment of a reasonable level of debt, permit the raising of needed equity capital, and cover the effects of inflation and (b) ensure retention and attraction of capital in amounts adequate to provide a sound transportation system in the United States.

The Act instructed the Interstate Commerce Commission (ICC) to use revenue adequacy as a criteria in evaluating the acceptability of rate increases proposed by the railways[50]. In order to implement the revenue adequacy criteria, the ICC initiated a proceeding, Ex Parte 338[72] to examine the standards and procedures for the establishment of adequate railroad revenue levels. Confirming the results of the Ex Parte 271 process, the Ex Parte 338[72,pp283] decision called for the use of multiple standards for measuring the allowed rate of return for U.S. railroads:

> (a)(1)The revenue adequacy of the Nation's railroads on a composite level shall be judge in accordance with the criteria of section 15a(4)[51] and upon consideration of all pertinent financial indicators, including a rate of return on net investment equal to the cost of capital, other financial ratios, and the flow of funds.

Ex Parte 353[73] was to be the first of the annual determinations of revenue adequacy required by the 4 R Act. Under the rules set out in Ex Parte 338, the ICC had decided to use multiple standards in setting the revenue adequacy levels. However, there were no guidelines given as to the relative weights to be given to the various standards.

The major difficulty encountered was an apparent contradiction between the fair return on net investment test and the funds flow test. While lengthy, the ICC's[73,pp222-224] reconciliation of the two approaches is instructive and is quoted below:

> These two tests imply different viewpoints concerning the return required on existing assets.
>
> Where earnings are regulated by a rate-of-return limitations, investors expect to earn the same return on new investment as on existing investment. Thus, a return on existing investment at least equal to the cost-of-capital rate is necessary to induce the making of new investment. Under this type of regulatory scheme a fair rate of return on existing investment is indeed necessary for the attraction of capital.
>
> A funds flow test, on the other hand, is more appropriate for an industry whose overall earnings are not limited under a rate of return standard. For such an industry, the chief prerequisite for the inducement of new investment is that such new investment itself be allowed to earn return at least equal to the cost-of-capital rate. Where this condition is met, actual investment decisions will be based on profitable investment opportunities, not on the return being earned on the book value of existing assets.
>
> Such an industry is the railroad industry. Regulation of overall earnings is not necessary for this industry, because so much of its operation is in competitive markets. In fact railroads are not subjected to direct regulation of overall earnings, and the returns being earned on their existing investments do not represent a limitation on the returns possible from judicious new investments. Indeed, large investments are now being made in the railroad industry, despite relatively low returns on the book value of existing assets. A funds flow test is useful in these circumstances, because it permits a determination of the earnings needed for a specific objective, such as providing a profitable return on a given amount of new investment.
>
> Nevertheless, the two aspects of section 205 can be reconciled if the fair return standard is not applied in a traditional public utility type of earnings regulation. The fair return level can serve as a valuable benchmark by which to judge the success of the

> railroads' investment programs. That is, as unprofitable old investments are retired and new investments are made that earn cost-of-capital return, a successful carrier's overall rate of return should gradually come to approximate the fair return level.
>
> Thus, we may regard a return on net investment equal to the cost-of-capital rate as a "maximum" adequate revenue level, while we look to funds flow analysis and related factors for the minimum. By a "maximum" we do not mean to imply that overall earnings would be held down to a fair return level by regulatory action having that objective. Rather, we are merely recognizing that, with individual rates set at levels that make new investment profitable, the overall rate of return on investment should eventually rise to, but not substantially above, the fair return level. In other words, the fair return level provides a benchmark by which to measure the railroads' progress in improving their financial performance as they take all necessary actions to rationalize their plant and eliminate unprofitable investments. Regulatory action will be directed at establishing profitable but not excessive rates on individual services, and not at controlling the overall rate of return on investment.
>
> Incidentally, it may be seen that the cost of capital rate plays a dual role in this regulatory approach. By establishing the fair return level, it provides a useful benchmark for judging the carriers' earnings progress in the long run. More importantly, it shows the rate of return that must be earned on new investment in order to attract capital.

For the reasons set out above, the ICC did not totally reject the rate base rate of return approach. In fact, in the ICC's findings they designated a rate of return on net investment at 10.6[52] percent[73,pp245] for 1978. To put this in perspective the ICC analyzed the financial results actually reported by U.S. railroads[73,pp212-220,Appendix G]. They found that, despite growth in traffic and revenues over a 21 year period, return on net investment for all U.S. railroads declined from 3.95 per cent in 1956 to .61 per cent in 1977. Even when the effects of the Conrail losses are removed the general decline in the return is still evident. Furthermore, leaving out the small railways and focusing on the larger Class I railways the ICC found the industry was earning substantially below the 10.6 per cent level. This is illustrated on Table V-I[73,212].

A review of the ICC analysis reveals that only one of the 36 Class I railways[53] earned either the weighted average cost of capital (10.6 per cent) or the cost of equity capital (13.0 per cent) in 1975 to 1977. In this same time period the top eight carriers reported an average return on net investment of 6.72 per cent and all Class I carriers with at least a "AA" bond rating reported average earnings on net investment of 5.51 per cent. Commenting on these results, Borts and Gordon[73,pp219] both noted that the railway industry does not have the necessary inelastic demand to use the public utility approach to setting revenue levels. They point out that raising the general level of rates to a level required by the rate base-rate of return formula would not likely improve railroad earnings due to traffic attrition.

Although the Ex Parte 271[71,pp1494] decision had concluded that the reported net investment was accurate from an accounting perspective, its accuracy from an economic perspective was questioned in the Ex Parte 353 proceeding. Probably the most revealing analysis was the examination of the market to book value ratios for a number of the "quality" railroads which had traded securities. For these "quality" carriers the ICC found an average market to book ratio of only 52 per cent.[73,pp225] To allow these carriers a return of 10.6 per cent on net book value would be equivalent to allowing investors

Table V-1

Average Returns on U.S. Railroads
(Average 1975-1977)

	All Class I Railroads	Top Eight Railroads
Return on Net Investment[1]	1.82	6.66
Return on Net Investment (tax adjusted)[2]	1.27	6.72
Return on Total Capitalization[3]	4.26	9.31
Return on Equity[4]	2.74	10.82

Notes:
1. Net railway operating income divided by net investment.
2. Net investment is reduced by the amount of the deferred tax reserve and net operating income is increased by the investment tax credit.
3. Net operating income plus interest is used as the earnings.
4. Net income divided by shareholders equity.

about a 21 per cent return on the worth of their investment.

Commenting on the use of the net book value the ICC noted[73,pp222] that:

> It is certainly true that some railroad investments in operating property have proven to be less profitable than anticipated. Traffic levels and revenue opportunities have been impaired by such factors as changes in industry locations and an increase in the severity of competition from other modes of carriage.
>
> Once these investments are in place, however, it is in the railroads interest to continue them in operation so long as they earn any return in excess of the property's liquidation value. At the same time, the substandard returns on these investments depress the carriers' returns on overall investment below the cost-of-capital level.
>
> On the other hand, as the old investment is eventually retired and new investment suited to new conditions takes place, the overall rate of return should rise closer to the cost-of-capital level. Thus, while the rate of return on net investment equal to the cost of capital may presently be unattainable, future movement towards its achievement should be possible.

The last paragraph above summarizes the ICC's interpretation of two important issues raised during the hearing. The first concerns the criteria for evaluating railroad investment decisions. Where a company has its revenue levels controlled by the rate base rate of return formula, it will be governed in its investment decision by the return allowed on the existing asset base. The U.S. railroads are not so constrained. Consequently, the investment decision are not so influenced, therefore the decision to invest is based on the return the competitive market forces will permit. It is their investment decisions which will cause the reported return on net investment to rise toward the cost of capital level. Even when subsidized services are considered, as is necessary in the Canadian context, the same results would be expected. New investments in the subsidized services would earn the allowed rate of return on the net investment. Since this is higher than that earned on the balance of the railway investment, the new acquisition should raise the overall reported rate of return[54].

The second issue is related to the first and concerns the ability of the railway to attract new equity capital if the over-all allowed rate of return is below the market cost of capital rate. Proponents of the rate base rate of return formula argue that a return at a level less than the level computed by this approach will impair the ability of the firm to attract new equity capital. To maintain the financial integrity of past investments requires the use of the net book value as the asset base. If revenues can be collected at this level the result would be to drive the market value of the firm up toward the net book value and possibly above. This argument presuppose the railways could increase revenues to the allowed limits. Also, Borts[14,pp20] counters this argument as follows:

> There are some who argue that fairness to stockholders requires that a railroad earn a higher return than that necessary to attract capital. For example, in his testimony before the Commission in Ex Parte 349, Witness Foster argues "mere ability to attract capital is not a sufficient criterion for fair return determination if allowance is not made for the equitable interests of those who have already made investments in the railroad industry" (Foster, Verified Statement 2,pp14). But this

> principle does not require that the costs of past managerial and stockholder errors be borne by the current shippers of commodities by rail. The "equitable interests of those who have already made investments" are protected by an announced and consistent regulatory policy. Those why buy rail equities should be secure in the knowledge that variations in rail earnings will be due to underlying economic conditions, but not due to changes in regulatory policy. Regulators do not owe a railroad's present stockholders any particular level of stock prices. Were a regulatory commission able to guarantee a level of dividends, it would give the stockholder the same degree of protection and security as the bond holder. It would also eliminate the need for a higher return on equity.

The funds flow model is based on this latter argument. It estimates the minimum earnings expected by investors necessary to maintain their stock prices. For new investment it provides a return equal to the cost of capital on the net book value. This latter computation ensures railways will be able to attract new debt and equity capital. Undertaking these new investments will raise the market value of the firm providing they are successful projects.

Despite the preceding argument, the ICC was still concerned that, irregardless of the extent of profitable investment opportunities available to a railroad company, a low level of earnings on existing investment would impede its access to debt and equity capital markets. It was this concern which caused the ICC to append to the funds flow model two additional considerations. The first is the computation of an earnings level sufficient to provide adequate fixed charge coverage. Based on the evidence of investment bankers and on the actual coverage ratios for the "better"[55] railways, a target coverage ratio of 3.5 was selected.

The second appended computation to the funds flow model is one to determine the return required for the carrier to obtain all its needed equity capital from retained earnings. While the ICC accepted the argument that new stock could be issued to finance new investment on a theoretical basis, they did acknowledge some practical limitations of doing so. For the most part U.S. railways were not issuing new equity capital[56]. The rationale for this expressed by the railways[73,pp240] was that a stock sale would dilute book values and meet with an adverse market reaction. Therefore, it was decided to include in the funds flow analysis the rate of return necessary to provide needed equity funds from retained earnings.

To illustrate the variation which occurs with the three measures of revenue adequacy an illustrative example has been extracted from the Ex Parte 353[73,pp243] decision and presented on Table V-2. This example is based on a U.S. Department of Transport estimate of a required annual capital investment of $2,446 million for all Class I railroads.

Consistent with its policy, a number of alternative measures for an allowed rate of return were presented. The two main criteria for 1978 were a return on net investment of 10.6 per cent and funds flow target of 7.0 per cent. Thus it was determined that "an adequate revenue level for the nation's class I railroads as a composite is one that provides a return on net investment of between 7.0 and 10.6 per cent[73,pp279]. Using these criteria, 13 class I railroads were found to be revenue adequate and 23 were found to have inadequate revenue. As mentioned earlier, if only the return on net investment criteria were used, only one railroad would have been found to be revenue adequate.

Care must be taken in interpreting the results of the funds flow analysis. These are short term results. It is not contended that the railways could survive in the long term at the rates of return yielded by the model. If the railways are on their way to profitability the results of the funds flow computations can be viewed as transitional. As old investment is retired and replaced by new capital, the rates of return computed by the funds flow model will climb until they reach the current cost of capital.

The ICC's findings in the Ex Parte 353 case were not made without an expression of some of the limitations regarding their funds flow analysis. These are summarized and presented below[73,pp258-260]

a) No attempt was made to examine the causes of inadequate revenue.

b) The determinations were made largely from a historical perspective and do not address the ability of the carrier to meet his future long term revenue needs.

c) The determinations are made under existing conditions (i.e. the present structure of the rail system, the present demand for rail services, and the present corporate relationship).

4) The analysis was based on limited data.

Such limitations are not unusual in rate of return determinations. With a few more years of experience the procedure would likely have been improved. However, this did not happen. The Ex Parte 353

Table V-2

Selected Funds Flow Results for 1978
(Ex Parte 353)

Objective	Required Rate of Return on Net Investment
A. To provide a return on existing equity investment at the 1977 level and to make new investments profitable.	3.92%
B. To provide adequate fixed charge coverage.	6.24%
C. To provide required equity capital from retained earnings.	6.38%

decision was not completed until January of 1980. This was the same year the U.S. Congress passed the Staggers Rail Act (October). With the passage of this Act major changes were made to deregulate the U.S. rail industry.

The major thrust of the Staggers Act was to provide railways with substantial freedom to price their services. One restriction placed on the pricing freedom was to deny certain rate escalation privileges to carriers which have adequate revenue[57]. Since the funds flow model provides an estimate of the minimum rate of return, the ICC concluded it was not an appropriate standard of revenue adequacy under the Staggers Act[75,pp807-8].

> In Ex Parte 338 and Ex Parte 353, the Commission established standards and procedures for determining adequate railroad revenue levels. A return on investment equal to the cost of capital was only one of the four standards the Commission indicated it would use in considering revenue adequacy. Financial ratios as indicators of financial structure, and flow of funds analyses were among the other standards considered in Ex Parte 338 and Ex Parte 353. Along with the cost of capital, these standards established a range of revenue adequacy. The range's high value is a measure of the cost of capital. The range's low value results from the use of funds flow model. This low value for revenue adequacy, however, does not and was never intended to define a long-term level of adequate revenue. Rather, the low level calculation using funds flow analysis is applicable only when it is necessary to assure that regulation per se does not provide carriers with current rate of return on redundant plant. Furthermore, this measure conceptually establishes a minimum level of revenue adequacy. The 4R Act directed the Commission to help carriers achieve adequate revenues. The Ex Parte 353 flow of funds determinations represent minimum target levels to be achieved. Revenue adequacy determinations are used differently in the Rail Act (Staggers). In particular, carriers are not denied additional rate flexibility if they are deemed revenue

> adequate. Thus, the Commission's determination will, to some degree, hold carriers' revenues down to the adequate level. In this context, minimum standards are not appropriate.

The major reasons for rejecting the funds flow were that it yielded the minimum required level of earnings and it was a short-term measure. The first argument has already been explored in some detail but the second requires some explanation. In the funds flow model unprofitable old investments are retired and new investments are made that earn the marginal cost of capital. Therefore, a successful railway's overall rate of return should converge on the rate base rate of return level. The ICC did not want to limit the railway's pricing flexibility by using a short-run target level of earnings. In the Ex Parte 393 findings the ICC concluded the following[75,pp808]

> If we adopted the Ex Parte 353 minimum or short-term standard for use here, we would likely in the next few years find ourselves denying a railroad the pricing flexibility necessary to obtain long-term revenue adequacy simply because that railroad was making some progress t onward achieving that goal. In short would would be assigning the railroads the Sysphyean task of working toward revenue adequacy, and every time it come close robbing it of the very means it had used to get these. We do not believe this is desirable nor do we believe it was intended by Congress.

The ICC established its revenue adequacy standards using the rate base-rate of return formula[58]. Using this formula, only three small railways of the thirty-five class one railways were found to be revenue adequate. The practical result was that the ICC preserved the rate escalation privileges contained in the Act for most of the U.S. railway industry.

With changes in U.S. rail regulation and the modification of the revenue adequacy standards contained in Ex Parte 393, the ICC stopped using the funds flow model. Even though a revenue adequacy finding based on the funds flow computation was only made for one year, 1978, there was over a decade of research and debate behind the model. Starting with the Ex Parte 271 and continuing through the Ex Parte 353 proceedings, the model was developed and refined. Its use was not discontinued because the model was wrong but because it was inappropriate for the new regulatory environment.

4. SUMMARY

The funds flow model has been proposed as a source of supplemental information to the rate base-rate of return formula for regulators faced with a situation wherein the market value of the firms' assets is believed to be below book value. Its attractiveness lies in its direct approach to measuring revenue requirements thereby neutralizing the problems associated with the measurement of the asset base.

In addition to neutralizing much of the asset base problem, the funds flow model has two other attributes which may be useful to regulators. First it provides a mechanism to introduce the concept of revenue adequacy into fair rate of return determination. The discussion in Chapter III indicated clearly the importance of maintaining the financial integrity of the investor when setting the fair rate of return. By adopting the principle of maintaining the financial capital of the investor, the funds flow model is able to quantify for the regulator this important factor.

The second attribute of the funds flow model which was brought out in this chapter was orientation to the future. Generally speaking, most of the cost of capital models are based on an extrapolation of past trends. The funds flow model is concerned with the future earning requirements. It computes the earnings required to meet certain criteria of revenue adequacy.

This chapter examined the theoretical basis for the funds flow model, its key assumptions and the U.S. experience with the model. The model is based on the investment opportunities approach to the valuation of the firm under conditions of perfect competition. By using the perfect competition conditions as regulatory standards, it is possible to reduce the model to consideration of only the one year's required earnings. The other assumptions concerning capital market efficiency, expected earnings on new investments, investors' aversion to losing money on their investments and the income maximization goals of management are reasonable and not uncommon when compared to the assumptions necessary to utilize the rate base-rate of return formula.

The experience in the United States with the use of the funds flow model demonstrates that it can be useful to regulators in the rail industry. Clearly, the use of the net book value as the asset base was yielding unrealistic results. In addition, the U.S. experience showed the model could be administered albeit with a very large data requirement.

Canadian railways, like their U.S. counterparts, display the same characteristics which led the ICC to investigate the funds flow model. Reported earnings are significantly below the approved cost of capital rate. Also, there appears to be sufficient reasons offered in this chapter to believe that the asset base is overstated. Working on this premise the next chapter applied the funds flow model to the Canadian railways.

ENDNOTES

1. Without knowledge of what the time cost of capital is, it is not possible to say precisely whether a regulator is setting the allowed rate of return at or above the cost of capital.

2. Here reference is made to companies whose return on investment is not regulated.

3. It is assumed that the firms are in ventures of equal risk and use assets of the same vintage use the same accounting based depreciation computations.

4. Profitable refers to the economic definition.

5. The reference is to maximum rate regulation which is cost based. Since 1967 there has been only one maximum rate case.

6. Section 279 of the Railway Act[157] states the railways may consult with each other in setting rates.

7. With certainty of future expectations the distinction between stocks and bonds disappears. As this assumption will be dropped later, it is necessary to maintain the distinction between stocks and bonds.

8. Investors are indifferent between dividends and capital gains.

9. No transaction costs and differences in the taxation of dividends and capital gains.

10. This would also be the case under perfect competition (i.e. there are no economic profits in an equilibrium condition.)

11. The CTC approved cost of capital does not provide as accurate a comparison as would be achieved had the market cost of debt been used.

12. During the same time period the railways were claiming that they were not adequately compensated for passenger services. Where the railways were paid an amount equal to the long run variable costs of the service. The discrepancy really was one of whether or not they should receive some contribution to constant costs. Thus the impact on earnings is relatively small compared to the grain issue and was omitted.

13. The lines west of Alberta are the exceptions.

14. The reason there is no write-down of assets in this situation are many. Leaving economic motives aside, there are practical problems of determining the proper value of the asset and the use of group depreciation. With group depreciation, all assets which are physically similar are grouped into one asset account and an average rate of depreciation is applied to the account. The account is not closed until the last asset is removed.

15. The creation of excess capacity through new investments in recent years has created an interesting issue regarding who should pay for the excess; the current users or the shareholders. In the public utilities area, the National Energy Board, the Ontario Energy Board, and the public utility commissions of Missouri, Pennsylvania, and New York all make adjustments to the asset base to remove a portion of the identified excess capacity.

16. The CTC sets the allowed deprecation rates for road property and rolling stock based on engineering studies of the assets expected life.

17. The reader should remember that there is a corresponding overstatement of maintenance expense in the year when the original asset was replaced.

18. There has been in recent years gluts of railway rolling stock which has significantly depressed prices.

19. The allowed cost of capital for branch line subsidies are based on the net salvage value of the branch line assets except where new capital is placed on the line (i.e. new track or a new bridge). In this latter situation, the net book value is used. Furthermore, if the line is subsequently abandoned, the railway is entitled to receive the compensation equal to the undepreciated balance of the new asset.

20. It could be argued that, where the railways earn monopoly profits, all rules should be found to be to the detriment of the public interest. However, the NTA only contemplates individual rate appeals.

21. If the net book value has been used for the asset base and investors expect this to continue, they will have capitalized the resulting cash flow from the subsidized services into the share price. If the net book value is an overstatement of the market value, the share prices would have been bid upward.

22. For most of this discussion the funds flow model will be discussed in the contest of its role in setting a fair return on investment but reference to it as a measure of the cost of capital will also be made.

23. The reader will recall that the current costing procedures include capital costs. The procedure to determine variability of these accounts is to use a regression analysis to compute a relationship between net investment and traffic levels. There could be a good argument made for not using net book values in the road property regressions. It is possible that the accounting procedures etc. discussed previously could bias the variability computation. This is a major research problem and will not be considered further.

24. If r is greater than k then there will be an expected growth in earnings. In this case equation (5-1) could be used. Alternatively, by assuming a constant growth rate (g), an equation similar to the dividend growth model could be used where

$$V_1 = X_1/(k-g)$$

This situation will be discussed later.

25. There is the obvious exception resulting from those investors who sell a security short.

26. The returns on marginal investment have to be, at the minimum, equal to the marginal cost of capital used to refinance it.

27. A railway must be revenue adequate before some of the provisions for freight rate appeal can be accessed by a shipper. Subsequent discussion in this Chapter of the U.S. experience with funds flow analysis will cover this in more detail.

28. The discussion here is focusing on equity prices as the market value of the debt is primarily a function of prevailing interest rates. The obvious exception would occur if a company had a dramatic downturn in earnings thereby increasing the risk exposure of the bond holders.

29. Perfect competition would result in the return a new investment(r) equaling the marginal cost of capital.

30. Transaction costs will impede this ability to constantly buy or sell.

31. It is implied here that investors take into consideration all factors when valuing the security. Expectations concerning inflation risk or changes in the business or financial risk of the firm would all be incorporated into the market discount rate applied to the future earnings stream.

32. This is a departure from the U.S. model which merely transposes the previous years earnings into the next year without an adjustment for inflation.

33. In the case of railways there is a large amount of capital replacement which is necessary just to keep operating the system. Many of these replacement programs are not evaluated.

34. Unless there is a target capital structure, market weights should be used to construct the weighted average. This presents a difficulty with the railways because the market weights are not known.

35. It will be shown later that the use of a fair rate of return basis can be easily accomplished by adjusting the earnings level in the model.

36. In matters before the Interstate Commerce Commission the Ex Parte proceedings are usually hearings pertaining to applications for general rate increases by the carriers or to the examination of various administrative rules proposed by the regulator.

37. Numerous tests of capital market efficiency were conducted in the 1960's and 1970's. By and large, the evidence seems to indicate that capital markets are efficient.

38. The more generally accepted objective for management is to maximize shareholder's wealth. This difference will be discussed in the next chapter.

39. Starting in 1974 with the Hall Commission and the Snavely costing study there were a series of studies and commissions of inquiry which finally led to the passage of Bill C-155 in December of 1983.

40. In the previous chapter it was noted that some railway investments are not discretionary. These include mainline track renewal and other investments necessary to keep the system operating. Here we are talking about discretionary investments in things like rolling stock to serve a new customer.

41. It will be shown in the next chapter that rate of return considerations such as "second best" and provision of incentives can be incorporated into the model if the regulator so desires.

42. Only CP Rail has preferred and preference shares in their capital structure and they have not used this form of financing for many years.

43. CP Rail actually is the only one at this time running these regressions. CN will do so in the near future and until they complete their analysis will continue to use CP Rail's coefficients.

44. The most serious potential problem with net book value in cost analysis may be related to the percentage of costs that are determined to be variable with output. Depending on how inert and

underutilized assets are distributed within the regional observations used in the regression, there could be a serious over or understatement of costs.

45. For non-regulated industries this problem would not be of concern.

46. New investments are assigned a return equal to the marginal cost of capital. Therefore, they cannot contribute to the situation.

47. In equilibrium the market value and book value of the firm would converge. If excess returns are allowed the market value would exceed the book value.

48. There are three districts, north, south, and east. Since the east contains the bankrupt railways which later formed Conrail, the national figures are not presented. Of the three districts the western railroads are the most profitable.

49. It is interesting to note that in the Ex Parte 271 decision, the ICC also found the asset base to be correctly state from an accounting point of view. Rather than adjust the asset base to reflect the market value the ICC decided to rely on other financial indices.

50. The funds flow model addressed all the needs of the ICC in implementing S205 (cited earlier) of the 4 R Act.

51. The reference is to S 15 a (4) of the Interstate Commerce Act. This section sets out the fair rate of return criteria to be used by the ICC (see Chapter 3).

52. This was based on the following components:
    debt ratio - 40%
    equity ratio - 60%
    cost of debt (embedded 7.0%
    cost of equity 13.0%

53. Only the Churchfield Railroad Company earned a return (11.70%) on net investment above 10.6 per cent.

54. If the railway had a market value greater than book value then the investment in the subsidized services would have a downward bias on reported earnings. However, when the market value exceeds book the company is earning monopoly profits and a much more significant policy question must be addressed.

55. The term "better" is used in ICC decision but is not defined. Based on a reading of the decision it most likely refers to those rail carriers which are reporting relatively strong financial results.

56. Except for convertible securities there has been no new equity related financing by U.S. railroads for several decades.

57. The Staggers Act makes the conditions under which a shipper may appeal a rate increase very restrictive if the railway involved is not revenue adequate. In addition the Act permits carriers which are not revenue adequate to implement rate increases each year equal to 4 per cent of its adjusted rate base.

58. Not only did the ICC adopt the rate base rate of return formula, they also allowed on their computation a return on deferred taxes and used the market cost of debt.

CHAPTER VI

FUNDS FLOW ANALYSIS FOR CANADIAN RAILROADS

The preceding chapter examined in some detail the conceptual and theoretical basis of the funds flow model. So far only an outline of the model has been presented. In this chapter the funds flow model will be used to estimate the revenue requirements for CP Rail and CN Rail for the years 1977 to 1982.

On the surface the model appears to be quite straight forward. However, to implement it requires a large amount of data and numerous computations. Most of this data and analysis has been relegated to two appendices, one for CP Rail and the other for CN Rail computations. The focus in this chapter will be on the approach used, the modifications made to the ICC model and the detailed assumptions necessary to conduct the analysis. In the latter part of the chapter the results will be presented and their sensitivity to key assumptions analyzed.

Before proceeding two very significant data related problems need to be pointed out. The first of these has already been mentioned. That is, neither CP Rail or CN Rail are separate corporation entities. They are divisions of a parent corporation. Consequently, significant financial decisions such as dividend policy, capital structure, investment policy, and debt management are governed by broader corporate considerations. To the extent corporate policy causes the railway to deviate from a policy they would assume as a 'stand alone entity', some bias can enter into the model. The relationship between the division and the parent organization is complex with benefits and costs of various financial decisions flowing both ways between the two organizations. No attempt is made to adjust for any apparent anomalies as such adjustments would in almost all cases be arbitrary. They are, however, noted in the chapter and appendices along with their possible ramifications.

The second problem is much more serious. Canadian railways are not required to publish data to the same extent as their U.S. counterparts. In Canada the majority of railway cost data is treated as confidential and is not available to the public. While there is some information made public through Statistics Canada. Most of the data used in this analysis had to be obtained through secondary sources. These secondary sources of data, which will be described later were incomplete in many areas. Therefore, it was necessary to make a number of assumptions in order to fill in missing pieces of data required by the model. The incompleteness of the data also made it impossible in some situations to reconcile small differences in data values obtained from different sources. In some instances, problems with the data were resolved by making minor modifications to the model. These differences and modifications will be pointed out.

While the data problems are quite restrictive to this study, a regulator would not experience the same limitations. The information necessary to conduct a funds flow analysis is readily available to the

Canadian Transport Commission, however, full access to the data will only alleviate the second data problem described above. The regulator would still be faced with having to consider the ramifications of the companies financial policies.

1. THE FUNDS FLOW MODEL

The purposes of this paper is to evaluate the funds flow model on both a theoretical and practical basis. Previous chapters have set out a theoretical basis for evaluating the model leaving for this chapter the task of evaluating its practicability. To accomplish this the test of practicability has been broken into two parts. The first is to determine whether a funds flow model can be constructed from available data without having to utilize unreasonable or an excessive number of assumptions. This is really a test of administrative feasibility.

The second test is to determine whether or not the model will yield reasonable results. Since the true cost of capital is not known, the reasonableness decision has to be one of judgment. The information presented in Chapter V created a set of expectations regarding the results of a fund flow analysis. These expectations along with a comparison with the results of the more conventional cost of capital measures will provide the basis of determining the reasonableness of the funds flow model's estimates.

Both these tests require that an actual funds flow projection be computed. Therefore, data was collected for the period from 1976 to

1982 in order to construct funds flow projections for the six year period 1977 to 1982.[1] This period had to be chosen because it was the only one for which sufficient data could be found. It was only because of the Canadian Transport Commission's study and subsequent hearings on cost of capital[2] that much of the essential data for the funds flow analysis was made public. Unfortunately, CN Rail did not disclose the same amount of information as CP Rail. Of the information not available for CN Rail, having only a partial statement of the sources and uses of funds was particularly damaging to the CN Rail analysis. Since this statement is the key element in constructing a funds flow model, its absence necessitated that one be constructed from available information. Being a crown corporation, CN Rail presents a number of other analytical problems which further weakened the reliability of the estimates. The absence of a market for CN equities and the recapitalization of the railway in 1978[155] are two examples. For these reasons, the emphasis in the ensuing discussion has been placed on the analysis for CP Rail.[3]

Since the methodology used to conduct the funds flow analysis is based on the Interstate Commerce Commission model, the logical starting point is to briefly describe this model and how its parameters were estimated. The modifications made to model for purposes of this analysis can then be presented, along with the major assumptions necessary to construct the model.

1.1. THE U.S. FUNDS FLOW MODEL:

An outline of the funds flow model developed for use by the Interstate Commerce Commission was contained in the previous chapter. Appendix II contains a detailed description of the model used in Ex Parte 353[73]. From this appendix it can be seen that the model is designed to produce an after tax estimate of the required rate of return for a number of subsequent periods.

The most important element in the projection is the level of future capital expenditures. In constructing its estimates the ICC was guided by its concept of revenue adequacy. They were concerned with 'what should be rather than what would be'. Estimates of capital expenditures were based on the following[71].

a. The spending levels the railways should achieve in future to arrest the deterioration of rail plant and maintain the same level of service.

b. The investments required to meet the demand for future service.

In the Ex Parte 271[71,pp1579-1591] an extensive exercise was undertaken to produce a ten year projection of railway capital requirements. The estimates were based on a complex inter-relationship between projected traffic levels and capital requirements for infrastructure and equipment. This approach turned out to be too costly to replicate each year. Therefore, in the Ex Parte 353 funds flow projection estimates of required capital were set at 10 percent of the net investment in road and equipment property for the previous year.

The model then presumed that the new capital requirements would be funded first from depreciation allowances with the balance financed by a mixture of debt and equity. No difference between retained earnings and new equity was made.[4] The mixture of debt and equity was set at a target ratio of 40 percent debt and 60 percent equity.

Some less obvious aspects of the ICC model include the adjustments for 'rolled over' debt and retirement of earning assets. In the first case it was assumed that any debt maturing would be 'rolled over' by issuing new debt. The computation of the fixed charges for the forecast period includes a computation of the increase in interest costs resulting from the 'roll-over' of debt which will come due. As assets are retired their earning power is lost to the company. Using depreciation as a basis for estimating the value of the assets retired and the previous year's reported return on investment as a proxy for the earning power of the assets, an adjustment is made to the expected earnings from existing investments. Obviously, if the asset is replaced its cost would be included in the estimated capital expenditures and it would be expected to earn its cost of capital.

After taking into account the adjustments for debt 'roll-over' and asset retirement, the model then computes the earnings required to meet the three criteria for revenue adequacy discussed in Chapter V. It can be seen in the appendix how the model uses the previous year's net income as the estimate of the earning power of existing assets and how new investments are expected to earn their marginal cost of capital.

The final part of the analysis converts the required earnings into a percentage returns on total capitalization. Total capitalization was defined as the sum of the book value of the debt and equity financing employed by the company. In the Ex Parte 353 decision[73,pp244-245] the return on total capitalization was converted to a return on net investment. This adjustment was arbitrary. An examination of available data showed the return on net investment to be about 2.5 percentage points below the return on total capitalization.[5] The reason offered for this was that the net investment was larger because it included deferred tax reserves.

1.2. A FUNDS FLOW MODEL FOR CANADIAN RAILWAYS:

The funds flow model used in this paper is, to a large extent, based on the Interstate Commerce Commission's model described above. Some changes had to be made to account for differences between the two countries. In addition, the model was modified to a limited extent in order to allow a better basis for comparison with the conventional rate of return measures. The details of the model are given in Appendix III along with the identification of the data sources used. The discussion here will focus on an overview of the model and the modifications made to it.

Before observing the model in detail there are two fundamental changes which had to be made in order to meet the objectives of this paper. Ideally, the funds flow model should be used on an ex ante basis. The analyst should look forward from a particular point in time and formulate projections of future cash flows. Then, using estimates of the current and embedded costs of capital, compute the levels of income necessary to meet the various criteria for revenue adequacy. Obviously, such an exercise introduces elements of imprecision and thus of uncertainty. These elements of uncertainty can be broken into two components: those pertaining to the cash flows and those pertaining to the cost of capital elements. As discussed in Chapter II, the second source of uncertainty cannot be eliminated. It can only be reduced by using the best techniques available for estimating the cost of capital. The same situation exists for the first source of imprecision.

For the purpose of this paper, an effort is made to eliminate the first source of uncertainty. This is done for two reasons. The first relates to one of the criteria established to evaluate the funds flow model; that is, to determine if the model yields quantitative results which are consistent with the premises on which the model was built.[6] The most obvious test relative to this criteria is to compare the funds flow results with those of the conventional rate base rate of return formula. In order to get as good a comparison as possible, it is necessary to have a forecast of cash flows as close as possible to investors' expectations. This is accomplished by assuming investors have perfect information and are able to estimate exactly the subsequent period's cash flows. Such an assumption is consistent with the efficient capital markets hypothesis discussed earlier in this paper. On average, investors must estimate the future periods' cash flows accurately or one investor would be able to out perform the market.

By assuming perfect information it is possible to substitute in actual cash flows as the estimates for the future periods. This leads to the second reason for eliminating the uncertainty with the project cash flows. It is the practical problem of producing a good estimate with publicaly available data. The U.S. experience showed that, even with a good data base, it is a very arduous task to produce estimates with the necessary accuracy. Crude forecasts could be produced but their affect would be to greatly weaken the comparison of the funds flow model with the rate base - rate of return formula. Therefore, to facilitate this comparison, which is fundamental to achieving the objectives of this paper, actual cash flows for the sources of funds and capital expenditures are used.

The second major deviation from the ICC model is related to the treatment of future capital expenditures. It has already been pointed out that this is one of the critical variables in the funds flow analysis. In the U.S. application of the funds flow model the level of future capital expenditures was set at a level determined to be necessary to ensure the continuation of a viable railway system. At the time the funds flow analysis was being used by the ICC, there was an over-riding policy concern with the deterioration of the railway infrastructure in the United States.[7] Therefore, the funds flow projection was computed using estimates of capital needs. In fact, the forecast of capital needs used was considerably higher than the level of capital spending of even the strongest railroads. This approach to setting the capital requirements while valid in the proper context, is not appropriate for the purposes of this paper.

The approach, taken in this paper, to estimating the future capital expenditures is to use the level of capital expenditures expected by the investors. It is this amount which is incorporated into investors' expectations. Using a projection of the amount of capital required by the railroads based on an arbitrary standard would, in all liklihood, cause the estimates to deviate from that expected in the market place. Since one of the tests of the funds flow model is to compare it to the rate base-rate of return formula, the comparison should be made on as similar basis as possible.

One additional concern with the capital forecast needs to be pointed out. There is reason to believe the Canadian railways were experiencing capital constraints due to the burden of the Statutory grain rates during the period of this analysis, but there is no reason to believe the investors expected higher levels of investment than the railways had planned. Investors may have attached some probability to the constraints being eliminated. For the period under investigation, this probability would likely have been small in the early years but would have increased dramatically toward the later years. Therefore, the impact of the Statutory grain rates is considered later in the chapter.

The change in the approach to estimating the capital forecast does not alter the validity of the three criteria used to evaluate revenue adequacy. It does however, change their meaning and relative importance. With the use of a capital estimate based on expectations rather than need, the measures of revenue adequacy reflect the minimum earnings required to meet investor expectations. This contrasts with the ICC model which measured the minimum levels of revenue adequacy necessary to achieve the desired levels of investment. In interpreting the funds flow results the ICC did not attach significantly greater weight to any of the criteria. If any, they leaned toward the third criteria; returns required to provide required equity capital from retained earnings. In the Canadian context and for purposes of this analysis significantly greater weight must be given to the first criteria. It is this criterion which reflects the basis on which the funds flow model was built. While both CP Rail and CN Rail have been financing their capital expansions primarily from retained earnings,[8] this is something the regulator would have to take into consideration when setting the allowed rate of return. Criterion I provides the estimate of the minimum level of earnings required to maintain the financial integrity of railroad investors. Criteria II and III provide regulators with valuable information to use in the decision making process.

It has already been mentioned that the funds flow model is based on an analysis of sources and applications of funds. Therefore, it is important to be clear on the models assumptions regarding the timing of the cash flows. The model used in this analysis is constructed using a base year which can be thought of as the current year. Using the base year, the model constructs the required rate of return for the subsequent period or forecast year. It is assumed that internally generated funds are made available throughout the forecast period for capital investment. Any shortage of debt or equity capital is made up by borrowings, retained earnings or new stock issues in the forecast period. Although it is assumed that new capital is raised during the forecast period for ease of computing the cost of new debt is taken for the entire year rather than pro-rated through the forecast period. This assumption could be relaxed for a more refined analysis. Therefore, any new debt or equity raised from external sources in the base period was used in the base period and is not available to finance new expenditures in the forecast period. Capital expenditures in the forecast period are financed in that period by new debt and equity.[9] The determination of the new debt and equity required is a major part of the funds flow model.

The model determines what level of earnings are required for the forecast period to meet each of the three revenue adequacy criteria. These timing assumptions are necessary to simplify the model and to utilize the available data which is published annually. Whether these timing assumptions differ significantly from the ICC model is not known. Nowhere in the available information was this discussed.

The mechanics of the funds flow model and the modification to the ICC procedure is presented below using the nine steps identified in Chapter V.

1.1.1. Estimate Sources of Funds: There are numerous approaches to measuring and presenting sources and uses of funds. For purposes of the funds flow model the objective is to identify the net sources available for financing new capital additions. The usual sources of these funds are net income, depreciation, deferred income taxes, and new capital. In addition, the data available for CP Rail and CN Rail demonstrated that significant funds are made available through the sale of salvage and property.

The ICC model did not identify deferred taxes, salvage and sale of property as sources of funds. They are included here because they are legitimate sources of internally generated funds and reduce the amount of capital required.

When the funds flow model presented in Appendix III is compared to the normal sources of funds described above some notable differences occur. The first is that net income does not appear as a source of funds. This is because the model is designed to estimate the earnings required to meet the three criteria for revenue adequacy. Looking more closely at the model it can be seen that net income is treated as part of new equity required to finance capital additions. No distinction is made between externally generated equity and retained earnings except in the case of the computations for the third criteria where all equity is to be internally generated. Obviously this implies that there are no transaction costs or impacts on share prices due to dilution of book value per share.[10]

1.1.2. Estimate Applications of Funds: Due to the structure of the model, applications of funds are all but ignored. Normally the source and application of funds statement would include in it applications such as dividends, the cost of redeeming preferred stock and retirement of debt. Of these, only the redemption of the preferred stock needs to be taken into consideration in this model.

The redemption of preferred shares is unique to CP Rail and is included as an application of funds in order to avoid under estimating the amount of new capital required. It is for ease of presentation that this use of funds is deducted from the sources of funds computed in the first part of the model. The preferred stock issued by CP Rail requires the annual redemption of a specified portion of the shares. Since these securities are allocated primarily to rail[11] the majority of the redemption costs must be financed out of railway retained earnings. This is a variation on the ICC model in that it did not consider any applications of funds.

Dividends are not included as an application of funds because they are paid out of the estimated required level of earnings. Since the model estimates the required after tax net income before dividends are paid out, it is not necessary to incorporate them as a use of funds. Only in the computation of the required earnings for criteria III are dividends explicitly accounted for. However, here their inclusion is necessary because of the manner in which the required earnings are computed. Simply stated, in criteria III, a net income is viewed as having two components; one that is paid out as dividends and the other which is reinvested in the company. When these two components are summed, they yield the required net income after tax and before dividend payout.

Debt retired is also not identified as a use of funds. This is due to the model focusing on 'net' changes in the sources and uses of funds. The model is built on the premise that the railways are expanding entities.[12] It is presumed that they are not using internally generated funds to retire outstanding debt. In fact the model assumes that all debt maturing in the forecast period is rolled-over.

It is conceivable that a company with earnings exceeding the amounts required for capital expansion and dividends could retire debt. In fact the debt allocation procedure used by the railways' parent companies to adjust the capital structure, occasionally creates the illusion that debt is being retired. This procedure, which was discussed in Chapter IV, adjusted the amount of debt in the capital structure depending on whether or not internally generated funds are sufficient to meet capital needs. In years where earnings are more than required the amount of debt assigned to the railway decreases. The debt does not disappear, it resides with the parent company. There is a temptation to simulate the process by allowing the debt retirement in the computations. However, this would be inconsistent with the purpose of the funds flow model. The model is designed to estimate the minimum level of earnings required in a forecast period. It is not designed to simulate an arbitrary debt allocation process. Besides that, the decision to retire debt is a decision on the use of funds by management, not an automatic end result of a high level of earnings. The funds flow model assumes the base period capital structure is optional and will be maintained in the forecast period. So long as the railways are expanding, the likelihood of a true debt retirement situation is very small. If ever it was believed to be important the model could be easily adapted to accommodate it.

1.1.3. Forecast of Capital Requirements: The estimate of future capital expenditures is the most critical input to the funds flow model. It has already been explained that the actual level of capital expenditures was used for purposes of this analysis rather than an estimate. Canadian railroads were not experiencing the same degree of financial hardship as their U.S. counterparts, and were, therefore, able to make sufficient investments to sustain most of their investment and accommodate new traffic. While this was generally the case, there were exceptions. During the study period, branch line, passenger and grain services all deteriorated significantly. The railways were unwilling to invest in these services due to inadequate compensation and uncertainty concerning their future.[13] This led to massive injections of public funds for the purchase of hopper cars to carry grain, the rehabilitation of branch lines, and the establishment of Via Rail.[14] This injection of public funds can be viewed as evidence of an understatement of the capital required by using the actual expenditures. Alternatively, it can be argued that these public expenditures are necessary to sustain a service deemed to be in the public interest and, therefore, not an obligation of the railway. Rather than resolving this issue, the sensitivity tests conducted later in this chapter will include adjustments to the level of the capital forecast.

During the late 1970's the rapidly expanding demand for Canada's resources put a great deal of pressure on rail capacity serving the west coast. The railways argued that they were being constrained in their ability to meet these demands because of the losses being incurred on the movement of Statutory grain. However, the extent to which capital spending was constrained is not known. Therefore, the sensitivity tests also include an upward adjustment to railway revenue to demonstrate the impact of compensatory grain rates on the returns required by the railways to finance their capital programs.

The interpretation of the capital expenditure estimate also requires some explanation. Previously in this paper it was mentioned that the railways use a form of betterment accounting. Under their approach to accounting for capital additions only the materials portion[15] of a capital replacement is capitalized. In the case of new assets, both labour and material and capitalized. As a result, the maintenance expenses which are deducted to get net income include an element of capital expenditures, i.e. the labour costs associated with capital replacement projects. The impact of betterment accounting was also investigated during the Ex Parte 353 proceeding[73,pp221] by Robert L. Banks, an economic consultant representing the American Paper Institute. He concluded that:

> the use of betterment accounting, rather than depreciation accounting, for track structures seems to have a negligible long-run effect on the reported return on net investment. However, . . . the effect can be substantial (2 percentage points in his example) in a year when there is a large retirement or replacement.

This matter can not be pursued quantitatively any further. Nevertheless, the reader should note that there is a dramatic increase in capital expenditures during the study period.

To be consistent with the concepts behind the funds flow model, it is necessary to assume that all projects comprising the capital program will earn a return at least equal to the marginal cost of capital. Although this assumption is logically sound there are some aspects of railway capital spending which may lead to some deviation from this generally accepted minimum condition for capital spending. Some aspects of railway spending are non-discretionary. The common carrier obligation[16] requires that some expenditures be made just to maintain service. Such expenditures are not always analyzed for their profitability. The existence of these types of projects has an unknown affect on the required rate of return. However, it seems reasonable to assume that, on the whole, the railway would not undertake a capital program which would not, in total, yield a return at least equal to the marginal cost of capital.

1.1.4. Financing Capital Additions: The model requires some assumptions about how capital additions are financed. Internal sources of funds, excluding net income, are the first source of funds used. After these funds are expended external sources are used. For reasons given earlier, the previous year's net income is included along with new shares issued as external source of equity. New debt is assumed to be raised in the market place. Furthermore, it is assumed that the railways endeavour to maintain their capital structure at the same proportions as existed in the base year. No preferred or preference stock financing is used to raise new capital. This latter assumption is a reflection of a managerial decision not to use preferred stock financing.[17]

In Chapter IV it was noted that CP Rail and CN Rail, being divisions of the parent company, have capital structures determined by an allocation formula. Even though these capital structures appear to be heavily weighted to equity, they are accepted for purposes of this study. The task of determining an optimal capital structure is an extensive and imprecise exercise which is beyond the scope of this study. Instead, the sensitivity analysis contains an assessment of the impact of increasing the debt to equity ratios used for marginal financing of both railways.

To maintain the proportions of debt to equity as exist in the base year it is necessary to compute the debt to equity ratio for the base year and apply these proportions to the amount of capital required. By treating the base year's net income as a source of new equity, the capital structure is maintained in the forecast period. In the case of CP Rail, the structure is not maintained exactly because of the existence of accumulated deferred taxes and preferred stock in the total capital structure. Depending on the level of capital expenditures, the relative importance of deferred taxes will increase or decrease. In addition, the decision not to use preferred stock as a source of new capital will cause it to reduce in relative proportion to the other elements of the capital structure.

1.1.5. Computation of the Costs of Debt Financing:

The purpose of this part of the model is to identify the cost of existing and new debt in the forecast period. There are two sources of new debt which have to be taken into account. The first is quite obviously the cost of new debt required to finance the planned capital expenditures.

The second occurs due to the fact that in each year some outstanding debt matures. As already mentioned, it is assumed that in the case of an expanding railway the maturing debt would be 'rolled over' by issuing new debt to replace it. This increases the cost of debt which has to be taken into consideration. The cost of the remaining debt (i.e. existing debt not due in the forecast period) is simply the embedded costs of these debt instruments.

To compute the cost of debt financing, the model requires both the embedded and marginal costs of debt. The embedded cost of debt is simply a weighted average of the costs of all debt due after the forecast period. Ideally the embedded cost should be the coupon rate divided by the net proceeds of the debt issue. Wherever possible this embedded cost was used. However, in a number of instances, particularly with CN Rail's debt, the net proceeds were not known and the face value of bonds were used.

The funds flow model also requires an estimate of the marginal cost of debt to compute the cost of new debt issued to finance capital additions and to compute the incremental cost of rolling over matured debt. Since the purpose of the model is to compute the earnings expected at the beginning of the forecast period, the marginal cost of debt is an estimate of the costs at that time. Furthermore, it has to be assumed that the magnitude and the size of the projects to be financed do not alter the business risk of the firm. With the debt equity ratio held constant and the assumption that all projects are profitable, the financial risk should also remain constant. In this analysis the marginal cost of debt is estimated using the average yield on railway long term bonds[18] for the forecast period. This measure is a proxy for investor expectations for the forecast period.

After computing the cost of new debt required it is added to the cost of existing debt due after the forecast period to get the total expected fixed charges for the year. This estimate will differ from the results reported by the railway for the forecast year. The reason is the allocation formula used by the railways to adjust the capital structure from year to year. Since the funds flow model maintains the capital structure for the previous year and the allocation formula does not, the results will differ.

The presence of preferred and preference stock in the CP Rail capital structure has to be taken into consideration. Even though no new preferred or preference stock is assumed to be issued, the annual dividends on these securities must be paid. Therefore, they are treated in a similar manner as debt. The model estimates the preferred stock dividends for the forecast period taking into consideration the annual retirement of preferred stock.

In the cases of debt and preferred shares some of the securities are denominated in foreign currencies, particularly British and American.[19] The current practice is to include a translation of foreign interest rates at current exchange rates when computing the embedded cost of debt. This approach[20] is accepted for purposes of this paper.

1.1.6. Computation of the Earnings Required To Provide a Return on Existing Investment at the Base Year Level and to Make New Investments Profitable: This is the first and most important of three computations of the required levels of after tax earnings necessary to meet the three revenue adequacy criteria. In this part of the model, the objective is to compute the level of earnings necessary to provide a return on existing investments at the base year level and to make new investments profitable.

The first part of this computation is to project the previous year's earnings into the forecast year as a measure of the earning power of existing assets. However, not all assets are available in the forecast period. Some wear out and are retired. To account for this the model includes a computation which reduces the base year's earnings. Even though the railways use group depreciation methods and base their depreciation rates on engineering studies, depreciation is used as the measure of the amount of assets retired in the base year. By assuming these retired assets have the same earning power as all other assets, the amount of the reduction in net income attributed to the retirement of old assets can be easily computed. There is one further adjustment which is made here that differs from the ICC model. The U.S. model assumed the earnings reductions due to the retirement of the old assets impacted totally on net income. This is somewhat imprecise in that part of the retired assets were funded by debt. Therefore, in this computation the amount of earnings reduction attributable to debt financing is factored out.[21]

For reasons already given, the base year's earnings net of the adjustment for retired assets, is indexed in an effort to better match investor expectations. There are two approaches which could be used to index net incomes. One would be to use a cost index and the other would be to use a price index. Because the railways publish many thousands of rates which do not change by the same percentage amount each year, there is no published index of railway prices. Therefore, the approach used here was to use an index of costs. This implies rates would be expected to increase to cover rising costs in the forecast period. Unfortunately, there is no published[22] index of railway costs. In its stead an index was constructed using available information. Indexes for labour, materials, fuel, depreciation, and cost of capital were found and combined into one composite index. The weights were also estimated based on information made available in the Snavely Report[19].

To estimate the required earnings on capital additions financed by new equity it is necessary to have a measure of the marginal cost of equity capital. For purposes of this analysis, the CTC approved rate for the forecast period was used. This rate was chosen over the base year rate because it more accurately captures investor expectations at the start of the forecast period. The CTC sets its cost of capital rates as an average for the year under study. Therefore, the CTC determination for the forecast period can be considered a mid-year value.

In setting the required return on capital additions financed by equity, the cost of capital should be used rather than the rate of return. This stems from the purpose of the model which is to identify the minimum level of earnings necessary to meet the various revenue adequacy criteria. Obviously it is assumed the CTC determination reflects their estimate of the cost of capital. Without disclosure of the reasons for their findings it is not possible to confirm this assumption. In addition, the wide range of the costs of equity computed by the various models employed creates a considerable uncertainty in the Commission's determination. For these reasons, the analysis presented below includes an examination of the sensitivity of the results to changes in the cost of equity.

Obtaining a cost of equity capital for CN Rail presented a number of conceptual and practical problems. As a crown corporation, all equity in Canadian National is held by the government. Up to 1980 the Canadian Transport Commission used the cost of equity determined for CP Rail for CN Rail. After 1980 CN Rail was required to make a separate submission to the Commission. One of the main reasons for doing this was to give effect to the decision[116] not to allow CN to include in its cost of equity an allowance for income tax until such time as CN paid taxes.[23] Failure to agree on a methodology to estimate CN's cost of equity resulted in the CTC using CP's cost of equity without an allowance for income tax. Therefore, for purposes of this analysis this rate is also used.

The approach used to determine the cost of equity to a crown corporation is not an easily resolved issue. At one end of the spectrum there are arguments which concluded that the appropriate measure is the yield on long term Government of Canada bonds[113]. At the other end are comparable earnings methods such as the one used by the Canadian Transport Commission. To capture these extremes, the sensitivity test on CN Rails cost of equity includes the impact of using the long term Government of Canada Bond Rate.

The next component of the calculation is to estimate the return expected on those assets financed by funds generated by depreciation, deferred income taxes and other income. In the first part of the computations the net funds available for capital additions were determined by deducting from these sources of funds the cost of the redemption of preferred stocks. This net amount is multiplied by the weighted average cost of capital to obtain the required after tax earnings. In computing the weighted average cost of capital deferred taxes are included in the capital structure at an zero cost. This is consistent with the CTC's treatment of the deferred tax issue in the 1979 Income Tax Case[116] and is consistent with the approaches used by other regulatory bodies. The approach used here deviates from the ICC model in that the ICC only computed the required return on funds generated by depreciation.

The final step in this part of the computation is to sum the required earnings on existing assets, new assets, and assets acquired using the other sources of funds.

Treatment of preferred dividends under this criteria requires some explanation. When the prior year's income is projected into the forecast period, preferred dividends are taken into consideration. This occurs because preferred dividends are paid out of net income. Thus by projecting the net income forward into the forecast period, the level of earnings necessary to pay the preferred dividends is included. In computing the earnings required by the other two criteria, preferred dividends have to be explicitly accounted for.

1.1.7. Computation of the Earnings Required to Provide Adequate Fixed Charge Coverage: This criteria for revenue adequacy is the most straight forward of the three used. It is simply the computation of earnings required to meet a target debt coverage ratio. The target used was 3.5 times interest costs. This was the coverage ratio used by the Interstate Commerce Commission in the Ex Parte 353 decision[73,pp239-240]. The ratio was chosen as one consistent with the experience of those railways with good bond ratings. It was decided to use the ICC target coverage ratio because it was determined for 1978 which is within the years being analyzed. With the heavy dependance on U.S. financial markets the coverage ratios deemed adequate for the American railways should apply to the Canadian railways.

The 3.5 coverage ratio was used throughout the study period. However, increasing inflation through this period coupled with the recession raises some question as to the validity of holding the coverage ratio constant. Rather than undertaking an analysis of the appropriate coverage ratio, the sensitivity of the results to different coverage ratios was tested and will be discussed later.

The one element of this computation which causes some difficulty is the selection of the appropriate tax rate to convert the required earnings to an after tax figure. There are numerous ways to approach the tax rate problem each with its own merits and advocates. The issues are complex and well beyond the scope of this study. In doing this analysis the approach used was the one proposed by CP Rail and given "conditional support" by the CTC.[120,Appendix C,pp2]

To compute the tax rate, the statutory rate[24] is adjusted downward to reflect a portion of the benefit of the investment tax credit. The entire 7 percent investment tax credit is not taken because the credits are deductible from the pool of capital cost allowances. In giving this procedure "conditional approval" the CTC staff[120,Appendix C,pp2] stated that, "the calculation of the impact of federal investment tax credits on CP's statutory income tax rate, appears to understate the benefits received". Depending on how the investment tax credit is handled the tax rate can deviate up to the full amount of the investment tax credit (7 per cent). Therefore, this range is used in the sensitivity analysis. Such a test is only illustrative because the capital cost allowances and the resulting deferred taxes would be affected by a change in the treatment of the investment tax credit which reduces the tax by the full amount of the credit.[25]

In the case of CN Rail there are no taxes paid. Therefore, to capture investor expectations, none are included in the analysis. This creates some discrepancies when comparing the results between the railways. To illustrate its impact, the sensitivity analysis includes a 50 percent tax rate for CN.

1.1.8. Computation of the Earnings Required to Provide Required Equity Capital From Retained Earnings: In order to provide the required equity capital from retained earnings, it is necessary to have sufficient funds to pay all dividends as well as finance the capital additions. The basic assumption in this calculation is that the dividend payout policy remains the same from year to year. With both railways being divisions of the parent company it is assumed that a predetermined percentage of net income is transferred to the parent as a dividend.

CN Rail's equity is held by the Government of Canada. In the period up to the 1978 recapitalization[155], CN paid no dividends. However, one of the conditions attached to the 1978 recapitalization was that CN would thereafter be required to return 20 percent of its net income to the Government of Canada as dividends.

The procedure for computing the expected dividends in the forecast year is based on the computations made for the first criteria. Using the expected net income from old assets, the expected dividends are computed by assuming the percentage dividend payout remains the same as the base year. Since the expected net income has already been adjusted to reflect the loss in earnings caused by the retirement of old assets, a similar adjustment was not required here. The ICC used a different approach to estimating dividends. Their analysis computed divided yield as a percentage of the book value of the investment. Based on an examination of the dividend payout of the railways it was concluded that the best method for computing expected dividends was a percentage of net income. Were the railways separate entities such an approach would not be appropriate because dividends would fluctuate considerably more than would be realistic.

For the same reasons, the dividend yield on new investment, was calculated as the same percentage of expected earnings. To complete the calculation, the cost of capital additions which have to be financed by equity are added to the cost of the dividends.

1.1.9. Computation of the Required Return on Net Investment: The final step in the model is to convert the estimated earnings levels into the conventional return on net book investment. Not only does this conversion permit comparisons but is necessary in order to be able to use the results. It has already been pointed out that the costing methodology computes the variable capital costs by analyzing how net investment is related to output.

The calculation is quite straight forward. The expected cost of long term debt was added to each of the three measures of required earnings and then divided by the net book value at the end of the base year. In the latter two cases preferred and preference dividends were added into the estimate of the required income.

2. RESULTS OF FUNDS FLOW ANALYSIS

The details of the computation are contained in Appendix III to this report. In addition to displaying the components of the funds flow model and the linkages between its various parts, the Appendix identifies the sources of the data used. In a number of instances, particularly with the CN Rail computation, data values were not readily available and had to be estimated. Where this was done, the basis on which the estimate was formulated is identified.

In Appendix II the algorithm is presented first followed by the computation of the required rates of return for CP Rail for the years 1977 to 1982. This part of the analysis is the strongest as data was more readily available.

The fourth appendix presents the analysis for CN Rail for the years 1977 to 1982. Since much of the descriptive material is the same for both railways, it is not repeated in the last appendix.

Tables VI-1 and VI-2 below contain the results for CP Rail and CN Rail respectively of the fund flow analysis for each of the revenue adequacy criteria. For the sake of comparison the CTC approved after tax cost of the capital rates are included at the bottom of the tables.

For the most part, the results appear to be reasonable and roughly what was expected. In order to provide a basis for evaluating these results it is useful to make a number of observations.

a. The rates of return computed for the funds flow model are, with a few exceptions, significantly below the weighted average cost of capital approved by the C.T.C.

b. While the funds flow and rate base rate of return results are different, they do follow roughly the same path. This path is consistent with the changes in the cost of capital experienced over the period studied. The funds flow appear to have responded less quickly to the rising cost of capital than the rate base rate of return formula. This would be due to the fact that the funds flow model only assigns the market cost of capital rates to new investments.

c. Not only do the funds flow results trace the changes in the market cost of capital rate, they are also strongly influenced by the rapid growth in the railway capital programs over this time period. In CP Rail's case, the capital program increased from $121 million in 1977 to $274 million in 1982 (See Appendix III). CN Rail's growth in capital spending was even more dramatic. It rose from $278 million in 1978 to a high of $565 million in 1981 before dropping back down to $470 million in 1982. Criterion I and II which are most sensitive to the capital forecast[26] follow this pattern very closely.

d. When compared to the rates of return reported by the I.C.C. for the Western railroads based on the funds flow model the results are very similar. At first glance it might be argued that this can only be an order of magnitude comparison. There are a number of differences

Table VI-1

CP Rail
Results of Funds Flow Analysis
Required Returns on Net Book Investment
(1977 to 1982)

Criteria	1977 %	1978 %	1979 %	1980 %	1981 %	1982 %
Earnings Required to:						
1. Provide a Return on Existing Investment At the Base Year Level and to Make New Investments Profitable	5.58	5.95	6.57	8.48	10.61	10.21
2. Provide Adequate Fixed Charge Coverage	3.69	3.69	3.61	3.38	3.92	4.87
3. Provide Required Equity Capital from Retained Earnings	4.07	5.78	5.80	7.37	11.61	9.90
CTC Approved Weight Average Cost of Capital*	10.43	11.13	11.50	12.52	13.42	12.90

* This is the rate approved for subsidy purposes. There are some methodological changes in its computation in 1979. It is the only after tax figure which is available for all six years.

Table VI-2

CN Rail
Results of Funds Flow Analysis
Required Returns on Net Book Investment
(1977 to 1982)

Criteria	Year 1977 %	 1978 %	 1979 %	 1980 %	 1981 %	 1982 %
Earnings Required to:						
1. Provide a Return on Existing Investment At the Base Year Level and to Make New Investments Profitable	3.92	6.00	7.04	9.01	10.84	9.81
2. Provide Adequate Fixed Charge Coverage	15.16	9.89	10.00	13.29	16.28	16.29
3. Provide Required Equity Capital from Retained Earnings	6.95	5.86	6.49	10.12	13.15	10.29
CTC Approved Weight Average Cost of Capital*	10.43	11.13	11.50	12.43	13.85	13.70

* This is the rate approved for subsidy purposes. Up to 1980 CN Rail used the same rate as CP Rail. After 1980, the CTC made preliminary findings on CN Rail's cost of capital which primarily reflected CN Rails higher embedded debt costs.

in the approaches to the capital projections and in the models used. However, despite the differences in approaches toward the estimation of required capital expenditures, the capital expenditures of the Canadian railways happen to be at the same 10 percent of net investment level used by the ICC.

e. The relationship between Criterion I and III is very interesting. It would have been logical to expect that the required rate of return for Criteria III would be the highest for an expanding industry. This turns out to not always be the case. In explaining this it is necessary to look at the relationship between the sources and uses of funds. A close look at the appendices reveals that in a few of the years, the internal sources of funds are greater than the capital program. In these years the required return for Criteria I will exceed that for Criteria III. This is logical because, the income required to meet Criteria III need not be greater than the base year income used to compute the required earnings for Criteria I.

f. When compared to the actual results reported by the two railways (Table VI-3) it can be seen that the funds flow results are in line with the actual experience. With a couple of exceptions the required rates of return identified in the funds flow analysis are higher than the actual results.

g. The earnings required for adequate fixed charge coverage show quite different results for the two railways. CP Rail has good debt coverage. CN Rail on the other hand will require a substantial increase in its earnings to have even a 3.5 times coverage ratio. The fact that CN Rail does not pay income tax pushes the required earnings upward.[27] Nevertheless, the results are consistent with what would be expected given CN Rail's heavier debt load and higher embedded debt cost.

h Although the required returns under Criteria I and III appear the same for both railways, care must be taken in interpreting this. Again, the tax position of CN Rail is an important consideration. Because CN Rail did not pay income tax during the study period the net income figure projected into the forecast period in the calculations for Criterion I is a before tax figure. Similarly, the dividends calculated for CN Rail in the years after the 1978 recapitalization are twenty percent of a before tax figure. Generally speaking, the CN Rail results are on a before tax basis and CP Rail results are on an after tax basis.[28]

Table VI-3

Reported Earnings on Net Investment*
CP Rail and CN Rail
(1977 - 1982)

	Year					
	1977 %	1978 %	1979 %	1980 %	1981 %	1982 %
CP Rail	4.81	5.17	6.49	7.76	8.06	7.35
CN Rail	4.76	5.48	6.42	7.20	7.75	2.67

* The formula used to compute the return on net investment was:

$$\text{Rate of Return} = \frac{\text{Net Income After Tax + Fixed Charges}}{\text{Net Book Value}}$$

2.1. SENSITIVITY ANALYSIS:

The funds flow model was constructed using a number of explicit assumptions. Where possible these assumptions have been tested to determine their average impact on the revenue requirements over the study period. The results of these tests are summarized on Table IV-4 and are discussed below. In conducting this analysis the selected inputs to the funds flow model where altered and the average percentage point change was computed. The inputs were selected not only to test the sensitivity of the model to its assumptions, but also to determine whether the model would respond in a logical manner to changes in the the variables.

2.1.1. Capital Costs:

The key input to the funds flow model is the project capital costs. Due to the limitations on railway earnings associated with the Statutory grain rates, there was some concern expressed that the railway's capital program might be artifiacially constrained. Therefore, the capital expenditures were increased by 10 percent in each year.

Ten percent was chosen as there was evidence that a large error in the capital expenditure figure was unlikely. Both railways were making capital expenditures at or above the target level set by the ICC in their study. Also, in a few of the years, CP Rail's internal sources of funds were greater than the uses, including dividends transferred to the parent.

Table VI-4

Summary of Sensitivity Tests
Average Percentage Point Change
(1977 to 1982)

	CP Rail Criteria			CN Rail Criteria		
	I	II	III	I	II	III
Sensitivity Tests						
1. Capital cost (+10%)	.16	.08	.91	.17	.20	.80
2. Marginal Cost of Equity						
a) + 2%	(.09)	0	(.04)	-	-	-
b) debt rate				(.04)	0	0
3. Capital Structure (40/60)	0	.17	(.69)	0	(.08)	.09
4. Debt Coverage (5.0)	0	1.28	0	0	5.69	0
5. Index = 100	(.53)	0	(.24)	(.30)	0	(0.6)
6. Tax Rates						
a) 43% - CP	0	.25	0	-	-	-
b) 50% - CN				(1.36)	(4.74)	0
7. Grain Revenues						
a) CN - No Tax	3.99	.11	3.0	5.21	0	1.28
b) CN - Tax	-	-	-	1.14	(4.73)	.24

When the model was re-run with the higher capital costs the impact on Criterion I and II was small. Over the six years the average change in Criteria I was an increase of .16 and .17 percent for CP Rail and CN Rail respectively. The impact on Criteria II was even smaller for CP Rail resulting in an increase of .08 percent in the required return. However, the additional capital cost caused a .2 percent increase in the second criteria for CN Rail. The major impact was on the required returns under Criteria III. Here the increased capital costs resulted in a .9 percent increase for CP and an .8 percent increase for CN Rail.[29]

Criteria I being more heavily weighted to the earnings on existing assets should not be too sensitive to changes in the amount of new investment. The greater impact on CN Rail than CP Rail with regards to Criteria II is to be expected. Given the greater reliance on debt financing and the difference in the taxable position, CN Rail is more sensitive to increased capital costs in Criteria II. Since the cost of financing the equity portion of new capital is directly added into the computation for Criteria III, it will be the most sensitive to a change in the capital expenditures.

2.1.2. Marginal Cost of Equity: One of the concerns expressed over and over again in this paper is the imprecision of the methods used to estimate the cost of equity capital particularly as they are applied to a division of a parent corporation and to a crown corporation. Therefore, two sensitivity tests concerning the cost of equity were devised.

The first test was done on the CP Rail results. Here the cost of equity was decreased by two percentage points. Such a change is equivalent to a 10 to 12 percent change in the cost of equity. The impact of this change was very small. On average the required returns dropped .09 and .04 percent for Criteria I and III respectively. Criteria II was unaffected. This is in marked contrast to what would happen with the rate base rate of return approach.[30]

The second test concerns the debate over the cost of capital to a crown corporation. Rather than attempt to resolve this issue it was decided to test one of the extreme cases. The cost of equity was reduced to the marginal cost of debt rate. Again the impact was very small. CN Rail's required rule of return under Criteria I only dropped .04 percent. Negligible impacts on the other two criterion were detected.

2.1.3. Capital Structure: In constructing the model it was noted that in the case of CP Rail the use of the embedded ratio of debt to equity for marginal financing appeared to be too heavily weighted to equity. To assess the impact of a change to less equity intensive financing of capital expenditures the marginal financing ratio was adjusted to 60 percent equity and 40 percent debt.

The greatest impact was on Criteria III for CP Rail. The greater use of debt reduces the required rate of return by .69 percentage points. In contrast, the required rate of return on CN Rail rose by .09 percentage points. This latter result can be explained by the impacts of the 1978 recapitalization and subsequent events. In 1978 CN Rail was recapitalized leaving it with a 60:40 equity to debt ratio. Since that time CN has used increasing amounts of debt financing. Thus, the impact of this test is to decrease the amount of equity financing used.

For similar reasons the required return under Criteria II rises by .17 percent for CP Rail and drops by .08 percent for CN Rail. There is no effect on Criteria I for either railway.

2.1.4. Debt Coverage Ratio: A 3.5 debt coverage ratio was used in the analysis for Criteria II. To determine the affects of changing this to a higher level to reflect increased market uncertainty, a ratio of 5.0 was substituted into the model.

The greatest impact was on CN Rail where the required earnings were driven up by 5.69 percent on average. In contrast, the required earnings for CP Rail were only increased by 1.28 percent.

2.1.5. Indexing Assumption:

One of the modifications made to the ICC funds flow model was to index the previous years' net income into the forecast period. Removal of the indexing has the greatest impact on Criterion I. Without indexing the required return declines for CP Rail by .53 percent and for CN Rail by .30 percent.

Criterion III results are also affected but to a lesser degree. A .24 percent drop is found in CP Rail's case and a .06 percent drop in CN Rail's case. No change in Criteria II requirements occur.

2.1.6. Tax Rates: There are two issues concerning the tax rate which were tested to determine their influence on the three criteria. The first concerns CP Rail's marginal tax rate. In order to ascertain whether the selection of the appropriate tax rate results in a significant change in the results, the tax rate was lowered from the statutory level to 43 percent. Such a rate removes the full benefit of the investment tax credit. Only the requirements under Criteria II are changed and they moved upward by .25 percent.

The most important tax issue concerns CN Rail. It is only by virtue of the loss carry-forward provisions of the Income Tax Act that CN did not pay taxes in any of the six years under study. It has already been mentioned that the omission of the income tax liability results in requirements which are more closely related to before tax estimates. To measure the impact of taxes two adjustments were made. The first was to include in the model a 50 percent tax rate for calculating the earning requirements for Criteria II. Net income was then halved to reflect a 50 percent tax rate. No further adjustments were made: however, it should be recognized that simply applying a 50 percent tax rate will understate cash earnings. The reason is that the beneficial affects of capital costs allowances and the investment tax credit are omitted.

The results for two of the three revenue adequacy criteria are changed. Criterion I and II move significantly downward by 1.36 and 4.74 percent respectively. With this change the CN results for Criteria II come more into line with those for CP Rail. Also, when taxes are accounted for the results for Criterion I move below those for CP Rail. This is more congruent with the reported actual results on Table VI-III.

2.1.7. Grain Revenues: The purpose of this sensitivity test is to measure some of the major impacts of the Statutory grain rates on the revenue requirements . It is not possible to say what would have happened to all the cash flows considered in the model if the railways had received compensatory rates for transporting grain. The approach taken here was to estimate the additional revenues the railways would have received and add these to the reported after net income. No provision is made for corresponding changes in investment, financing policy, or dividend payout ratios. Such changes would be highly speculative and are, therefore, only acknowledged.

Using the results of the Snavely Commission Reports[19][135][137] estimates of the additional net income which would have been paid to the railways were constructed[31]. The impact is significant mainly because the added revenue flows straight through to the bottom line.

Since the expenses associated with this traffic have already been accounted for, the estimated additional revenue can be added directly to after tax income.

In the case of CP Rail the required returns for Criterion I and II increased by 4 and 3 percent on average. On a year to year basis the addition of the compensatory grain revenues pushed, in three of the years, the required revenue above the rate base-rate of return level.

When CN Rail's net income is increased the required revenue increases but in a different pattern. The major change is in Criteria I which increases by 5.2 percent. However, the lower dividend payout ratio of CN Rail and the fact that it did not pay dividends in the first two years of the study period combined to hold the increase in the required returns for Criteria II down to 1.3 percent.

In the previous test, consideration was given to CN Rail's taxable position. Continuing on the same basis, the model was re-run incorporating the tax liability along with the increased grain revenues. The tax liability has a significant dampening affect on the increases in the required revenues. The increase in Criteria I is now only 1.14 percent and in Criteria II is now just .24 percent.

3. Summary

The purpose of this chapter was to conduct a funds flow analysis for CN and CP Rail in order to determine whether it was administratively feasible to construct the model and whether the model yielded reasonable results. To accomplish this the funds flow model was adapted to reflect the requirements of this study and the Canadian situation. The major changes made to the model included the use of actual figures as opposed to forecasts in order to facilitate comparisons with the rate base rate of return formula and the results reported by the railways. Also the model was modified to allow for preferred and preference stock financing including redemption provisions. The indexing of net income was the other significant modification made to the model to better reflect investor expectations.

Data was then collected for the seven years from 1976 to 1982 inclusive. In a number of instances where data was missing, estimates were constructed using the best available information. With a couple of minor exceptions, suitable data values were found for all necessary inputs. The difficulty encountered in collecting data was primarily a result of the need to use publicaly available information. Such a problem would not be encountered by a regulator or the railway companies.

The required rates of return for each of the three revenue adequacy criteria were then computed. In general the results appear to be consistent with the premises on which the model is built. Except when the Statutory grain rates are taken into consideration, the funds flow model yields results considerably below those of the rate base rate of return formula. However, when the results of the funds flow analysis are compared to the rates of return reported by the railways, they are fairly consistent.

Since a number of explicit assumptions were made in the funds flow analysis, an extensive sensitivity analysis was conducted. From this analysis it became apparent that the funds flow model is relatively insensitive to some of the issues which are important to the rate base-rate return formula such as the cost of equity, the debt to equity ratio, and the treatment of the investment tax credit. However, it is very sensitive to the key assumptions unique to the funds flow model. In particular, the results are sensitive to the level of net income, the forecast of capital expenditures and the debt coverage ratios.

The sensitivity analysis also showed that during the study period careful consideration has to be given to the treatment of the losses caused by Statutory grain. Now that this problem is resolved through the passage of the Western Grain Transportation Act, it need not be considered an issue.

The final chapter of this report will now combine the theoretical and practical aspects of the funds flow model into an evaluation of the model.

ENDNOTES

1. Seven years of data are required to construct five years of projections. Each year's model requires a base year (previous year) and forecast year.

2. In 1977 the CTC was instructed by an Order-in-Council to review railway costing regulation. This review eventually led to a full scale hearing on cost of capital which started in February of 1984 and finished in February of 1985. The decision is not expected until late summer or early fall of 1985.

3. The emphasis on CP Rail is consistent with current legislation which assigns CN, CP's cost of capital in some instances (min/max rate regulation and crow rate subsidies). These were mentioned in Chapter IV.

4. The major difference in the cost of these two sources is the transaction costs of issuing new equity.

5. Even though the information showed a 2.5 percentage point spread, the ICC used 1 per cent so that the margin of error favoured the railways.

6. The criteria were set out in Chapter I.

7. The 4R Act[159] had as one of its objectives "to provide the means to rehabilitate and maintain the physical facilities, improve the operations and structure, and restore the financial stability of the railway system of the United States".

8. The notable exceptions are equipment trust certificates.

9. Remember new equity includes the reinvestment of the previous years net earnings.

10. The dilution argument was discussed in Chapter V. It was pointed out that there was no theoretical barrier to issuing new equity but the problem was one of investors' perceptions of such an action.

11. In Chapter IV it was noted that the railway capital structure is allocated to it by CP Ltd. The allocation of preferred shares is between CP Rail and CP Telecommunications.

12. Canadian railways, as can been seen from the appendices, have been investing extensively in their rail systems.

13. It has already been noted that grain was moving at rates substantially below costs. Branch line and passenger services were under constant review during this period contributing to a great

deal of uncertainty regarding their future. The problem on branch lines was compounded by the fact most of them carried Statutory grain.

14. The federal and provincial governments have bought over 10,000 hopper cars at a cost of between $400 and $500 million. Seventy-five million dollars per year was committed to the Prairie Branch Line Rehabilitation Program.

15. The materials must be above an arbitrary limit. Otherwise they are expensed.

16. The railways are obligated to accept all traffic offered to them, within reason.

17. CP Rail is retiring its preferred stock and CN Rail does not have preferred or preference stock in its capital structure.

18. Bonds nearing maturity are excluded. Also the bonds are, in reality issued by the parent company.

19. In 1981 over fifty per cent of CP Limited's debt was denominated in foreign currency.

20. The alternative is to restate the interest rates to reflect the exchange rate when the debt was initially issued.

21. It is not necessary to adjust the expected cost of debt downward because it has been assumed that all debt is rolled over.

22. The railways construct a cost index but it is not public information.

23. This was for subsidy purposes only. The Railway Act and Western Grain Transportation Act require CN to use CP's cost of capital for rate regulation and rate setting purposes.

24. The statutory tax rate is the basic federal income tax rate, minus the Provincial abatement, plus the weighted average Provincial income tax rates, plus the federal corporate sur tax. In 1980 this totaled 51.561%.

25. When the income tax rate is reduced by the full amount of the investment tax credit, the total acquisition cost of new investment should be used for capital recovery purposes.

26. This is primarily due to the railways being equity intensive in their capital structure.

27. Without the tax factor, CN Rail's required earnings are essential before tax figures.

28. The CN model can be converted to an after tax figure by adjusting the data. However, the purpose of the model is to compute the revenue requirements and the fact that CN Rail pays no taxes affects its revenue requirements.

29. Although a .8 or .9 per cent change seems small, it must be viewed in relation to the required return which is averaging between 7 and 8 per cent.

30. With 70 per cent equity in the capital structure, a 2 per cent change in the cost of equity will have a 1.4 per cent change in the allowed rate of return.

31. The Western Grain Transportation Act sets grain revenues equal to the variable costs plus a twenty per cent contribution to overhead(fixed costs). Using the results of the 1974, 1977 and 1980 grain costing studies, the costs calculated in these years were indexed using a composite cost and volume index to fill in the missing years. From these total revenue levels estimates, the revenues already received from the shippers and thru branch line subsidy had to be deducted to get the net additional revenue the railways would have received. The last step was to factor down the CP Rail additional revenues by 50 per cent to account for the taxes which would be due on the additional revenue.

The results of this computation are given below.

Year	Additional Revenue ($millions)	
	CP	CN
1976	46.176	86.50
1977	52.731	96.39
1978	61.916	133.99
1979	71.10	171.60
1980	77.01	199.00
1981	81.43	210.30
1982	85.85	221.60

CHAPTER VII

EVALUATION OF FUNDS FLOW ANALYSIS

The objective of this paper was to evaluate the funds flow model to determine its validity on a theoretical basis and to assess its applicability to Canadian railway regulation. In this chapter, the funds flow model is evaluated relative to the criteria developed throughout this report. The results of this evaluation are then drawn together into a statement of conclusions. Finally, an assessment is made concerning the merits of further research in this area and the possible areas where further research would be beneficial.

At the start of this paper the following six criteria to be used to evaluate the funds flow model were enunciated:

a. The model must be consistent with existing financial theory on cost of capital determination.

b. The model must be consistent with existing regulatory theory on rate of return.

c. The model must contribute to the resolution of current issues related to the measurement of the cost of capital and rate of return.

d. The model must be based on valid assumptions.

e. The model must yield quantitative results which are consistent with the premises on which the model was built.

f. The model must be practical to implement.

1. FUNDS FLOW MODEL AS A MEASURE OF THE COST OF CAPITAL

The funds flow model purports to be a direct measure of the cost of capital to a firm. This contrasts with the popular contemporary measures such as the capital asset pricing model and the dividend growth models which measure the cost of capital indirectly as a percentage. Some of the more significant problems with the contemporary measures have already been discussed. Therefore, focus here is on the funds flow model. In this part of the evaluation only the first revenue adequacy criteria is considered; that is the earnings required to provide a return on existing investment at the base year level and to make new investments profitable. The other two criteria are included for purposes of setting the rate of return and do not claim to be measures of the cost of capital.

Generally speaking, so long as it is viewed as a method to identify the minimum return required by investors, the funds flow model is conceptually sound and consistent with modern financial theory. Like many of the market based, non-monetary cost of capital estimating techniques the funds flow model considers the purchase of a security as the acquisition of a risky income stream. The market value of the security is assumed to be the discounted present value of the income stream where the discount rate is the cost of capital rate. By focusing on the income stream, the funds flow model is able to sever itself from the measurement of the asset base. This is both the strength and the weakness of the model.

By now the problems with measuring the asset base for railway regulation are clear. The market cost of capital rates computed using contemporary measurement techniques are meant to be applied to the market value of the security, not the net book value. Without knowledge of the market value, the regulator chose to use the net book value. The greatest benefit of the funds flow model is its ability to circumvent this problem by measuring the required return.

A second major advantage of the funds flow model over the more conventional cost of capital estimating techniques is its greater capability of separating the past from the future. When the cost of capital is measured using most of the models used today, it is usually a projection of past experience into the future period. The funds flow model, on the other hand, constructs the future period estimate based upon explicit assumptions concerning cash inflows and outflow. Such an approach allows the analyst to be more explicit about future events. This fits with approaches used by many security analysts. The research report on Canadian Pacific Limited prepared by Wood Gundy Ltd.[129] illustrates this point. In this report the analyst develops explicit estimates of CP Ltd.'s net income, expenses, cash flows, dividends etc. for a three year period. Part of this analysis was an assessment of the impacts of the impending revisions of the Statutory grain rates. Herein lies one of the advantages of the funds flow model in that it can accommodate this type of change into the required rates of return and show their impacts. The ability to sever funds flow forecasts from the past is not complete. In so far as the model uses the market cost of equity computed using the conventional market based models to

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estimate the required returns on new investment, it is still linked to the past events. However, the sensitivity analysis showed that the funds flow model was relatively insensitive to changes in the value of the cost of equity.

Another attractive feature of the funds flow model from a financial theory perspective is its ability to directly estimate the minimum required rate of return on a wholly owned subsidiary or division. This is one of the critical problems facing regulators of railways in Canada and the United States. The model does not provide resolution of this issue; it only provides an estimate of the minimum required returns. However, this additional information would be valuable to the regulator when combined with other data already available.

The major difficulty with assessing the acceptability of the funds flow model is the absence of empirical tests. There have not been any tests of the funds flow model's ability to explain the structure of the capital markets. A test of this nature would be difficult because the model is designed to identify minimum required rates of return. Nevertheless, without these empirical studies to support the model it is not possible to make any definitive statement about the theoretical validity of the model. In fairness it needs to be said that such a test has so far eluded all cost of capital models.

Many of the basic assumptions underlying the funds flow model are similar to to those used by the more contemporary measurement techniques. In particular the assumptions that capital markets are efficient and in a state of equilibrium, that investors seek a positive real rate of return, and that the market value of the security is the present value of future earnings are common to almost all the non monetary cost of capital theories. Three other critical assumptions of the funds flow model are somewhat unique to the model and cause some concern.

The first of these is the reduction of the model to a one period analysis by assuming the return earned on new projects is equal to the marginal cost of capital. While this would be true in a perfectly competitive environment, it is potentially misleading in today's economy. Most companies select capital projects which have a return greater than the cost of capital. With unlimited capital budgets only the last project(s) selected would have a rate of return equal to the cost of capital. When available capital is constrained, as was the case in most of the years[1] looked at for the Canadian railways, the return on the projects selected is likely to exceed the cost of capital. The impact of selecting capital projects which have a return greater than the cost of capital is to drive up the market value of the security. Therefore, assuming the investor has perfect knowledge, he will value the security to reflect its actual earning power. To set an allowed rate of return equal to the marginal cost of capital will not protect the integrity of his investment where perfect competition does not exist. If the regulatory implications of allowing a return greater than the cost of capital are ignored, then this problem can be resolved by allowing the rate of return to exceed the cost of capital. This then requires the use of the multi-period model identified in Chapter

V. More will be said about this later when the funds flow model is evaluated as a measure of fair rate of return.

When the model was reduced to a one period computation it was necessary to include the assumption that the earnings being generated from the firm's existing assets are being maximized. Because the model takes the base year net income and indexes it into the forecast period to compute the required earnings for the first criteria for revenue adequacy, it is very sensitive to the income estimate. Obviously, events such as strikes, recessions etc. can cause the base year income level to not be indicative of the earning power of the existing assets. One way to improve the model might be to use a three to five year average of earnings.[2]

One of the criticisms aimed at the current procedures for estimating the cost of equity is that they are unstable from year to year, particularly when they are applied to a single security. The funds flow model has some of the same problems. Based on the results computed for the two railways, the year to year changes appear logical and relatively stable. However, the sensitivity of the model to the capital expenditures forecast gives rise to some concern. As already noted, the pattern of the capital expenditures paralleled that of the cost of capital. As interest costs went up so did railway capital spending. The reasons for this are not important[3] but if it is the pattern of capital expenditures which caused the required rates of return to parallel the cost of capital then the model should be viewed as being potentially unstable. Had capital expenditures followed a different pattern, the computed required rates of return may not have tracked the cost of capital. The same concern exists with regards to the pattern of net income and the cost of capital. These also parallel each other in the upward direction mainly as the railways pass on cost increases to their customers. Had the model been tested over a different time period, there is a possibility that the results would have been more unstable. These concerns cannot be resolved without additional research using long time periods and non-railway companies.

The funds flow model yields a unique estimate of the required rates of return for each company analyzed. This might appear to be at odds with financial theory as it is generally agreed that firms with similar risk characteristics will have the same cost of capital rate. However, it is the cost of capital rate which is the same. It does not necessarily follow that they have the same earnings stream or market value. In the funds flow model risk is not explicitly considered in computing the required earnings[4]. These earnings are discounted by investors using the opportunity cost of capital. This opportunity cost, which incorporates the investors' assessment of the risk associated with the income stream, is the cost of capital rate estimated by the conventional models. Thus it can be said that the funds flow model is consistent with financial theory in the treatment of risk.

To conclude this part of the evaluation it is useful to look back at the four common elements identified at the end of Chapter II as being important in determining the cost of equity. The only point on which the model may be weak is whether it is consistent with the opportunity cost concept.

One of the criticisms of the requirements formula, which is similar to the funds flow model, cited in Chapter IV was that it focused on the capitalization of the firm and did not consider the opportunity cost of the assets employed. In support of this argument it was pointed out that it is the opportunity cost of the assets which is important in measuring the costs of a particular service.

In a perfectly competitive market it could be assumed that the market value of the firm, measured using the values of its securities, would equal the market value of its assets. However, railways do not exist in a perfectly competitive environment. Barriers to exit from the industry, the common carrier obligation, and other regulatory constraints could result in the railways continuing to use assets which could be better employed elsewhere in the economy. In addition the railways employ numerous specialized assets which do not have alternative uses outside the railway industry. It is therefore possible that the opportunity cost of railway assets is different than the market value of the firm's securities. However, measuring the opportunity cost of the assets does not require that the regulator use the net book value. Based on the information contained in this paper, it would appear that the use of the net book value could lead to a serious missallocation of resources.

There is another point of view on the opportunity cost concept which results in a different perspective on this problem[111]. It is argued that the cost of capital measures the opportunity cost of the investor. By his decision to invest in the railway, he is giving up opportunities to invest elsewhere. It is from this perspective, the funds flow model, as well as the other conventional cost of capital models, compute the cost of capital. Both views of the opportunity cost concept are correct and equivalent under perfectly competitive conditions. It is the imperfections in the market place such as those mentioned above which cause this equivalency to break down.

Even though the model is consistent with the basic elements of cost of capital theory, it has not been empirically tested. From a conceptual point of view the model appears to be sound for a company operating in perfectly competitive markets. Where perfect competition does not exist and there are economic rents available to the firm, the model could be adapted to produce the minimum required rate of return.

2. FUNDS FLOW MODEL AS A MEASURE OF THE FAIR RATE OF RETURN

Where the funds flow model has the most to offer is in the determination of the fair rate of return. The required rates of return for each of the three revenue adequacy criteria offer useful information to regulators faced with the task of setting a short-run fair rate of return for a company or industry where the value of the asset base is suspect or non-existent. This is the situation which confronts the regulators of Canada's two trans-continental railways.

The funds flow model does not replace the rate base-rate of return formula. They actually complement each other in that the funds flow model(criterion I) provides an estimate of the minimum required rate of return and the rate base-rate of return provides the upper limit. As the railways make investments which yield returns equal to or greater than their cost of capital, the revenue requirements computed by the funds flow model will converge towards that of the rate base-rate of return formula. When the two methods yield the same results, the market value of the firm should equal its book value. It is for this reason that the funds flow model is considered a short term or transitory method for computing the rate of return. However, for an entity such as a railway which employs assets with lives in excess of thirty years, the short term can be a number of years.

Sufficient circumstantial and quantitative evidence was presented to be reasonably certain that the market value of Canadian railways is below the stated net book value during the study period. As a result, applying a cost of capital rate determined using market values to an historic net book value asset base will yield returns significantly above the level necessary to maintain the financial capital of railway investors. This difference between the market and the book value explains the apparent discrepancy between the report and allowed rates of return mentioned at the start of this paper. There is no easy way to resolve this discrepancy without moving away from the rate base rate of return formula. The discussion of the alternative asset valuation approaches showed that only the use of a market value or true replacement cost method[5] could potentially resolve the discrepancy.

However, each of these methods has serious drawbacks when used on a regulated company. Market value depends on the income stream. Therefore, the allowed rate of return affects the market value. There is also the practical problem of finding the market value of the regulated company when it is a division of a larger corporate entity. The major problem with the replacement cost approach is the difficulty in estimating the market price of the assets required to provide the same level of service. By focusing in on the required earnings, the funds flow model is able to neutralize the problems associated with the valuation of the asset base.

Each of the three measures of revenue adequacy produced by the funds flow model provide information to the regulator concerning the fair rate of return. The relative weighting given to the three criteria would be at the discretion of the regulator. However, no return should be below that identified in criterion I. This criterion reflects the minimum level of earnings necessary to maintain the financial capital of the investors. It must, therefore, be viewed as the base and if criteria II and III yield higher required returns they should be taken into consideration by the regulator.

In the U.S. experience greater emphasis was placed on Criteria III to reflect the industry's preference for internal equity financing as opposed to issuing new common stock. Whether this would be appropriate in Canada is not clear. Canadian railways are, in general, in better financial shape than their U.S. counterparts. In most of the years studied CP Rail was able to generate more funds than they used (see

Appendix III) and was able to easily maintain an adequate debt coverage ratio. Under these conditions it would appear appropriate to attach greater significance to the required returns estimated using Criteria I.

CN Rail presents the opposite situation. In all years studied, the railway did not have sufficient sources of funds to meet all requirements. Also CN Rail required very high rates of return to maintain adequate debt coverage ratios[6]. In this case it would appear logical to put greater emphasis on the other criteria. This would place the regulator in an awkward position of using different criteria for setting the fair rate of return for each railway.

In Chapter III a number of economic and legal criteria were identified as a basis for evaluating the funds flow model from a fair rate of return perspective. One of the more difficult problems associated with the fair rate of return was the need to minimize the missallocation of resources by eliminating monopoly profits while at the same time endeavouring to obtain the optimal level of output at the lowest cost. The ideal solution is to set prices equal to marginal costs. Even without considering the problems which arise when marginal costs are less than average costs, this objective is especially difficult to achieve in the railway industry. Unlike public utilities, the railways' profits are not controlled by the regulator. Instead, the regulation is designed to set guidelines for the pricing of railway services. The railways also have imposed public duties where they are paid for retaining a service they might otherwise reduce or abandon. For both rate regulation and compensation the basis of the cost computations is long run variable costs which include the cost of capital. With a few exceptions, the variable costs calculated are average costs,[7] not marginal costs. In the case of the cost of capital, the variable cost is computed by first using a regression analysis to related the net investment in various regions to measures of work done(e.g. gross ton miles). The cost of capital rate is then applied to the variable investment to get the cost of capital per unit of work done. Utilizing the funds flow model will change the cost of capital rate but not the variable amount of investment. Thus, the computation will still yield an average cost. To the extent that the funds flow model yields a better estimate of the cost of capital to the railways, it will result in a more accurate measure of average costs. It will not yield a marginal cost of capital unless a new method is found to allocate capital costs to individual railway services.

With regards to the necessity of dealing with "second best" solutions, it has to be remembered that the funds flow produces estimates of the minimum required return. However, in computing the required rate of return, one of the key inputs is the previous year's net income. It can then be argued that the net income would reflect the railways' pricing decisions in the real world and would implicitly capture some of the relevant realities of the market place. Off-setting this is the fact that the model assigns the marginal cost of capital to new investments. If "second best" considerations require consideration be given to allowing higher return on new investment it can be easily done without distorting the return required on existing investment. This cannot be accomplished with the traditional rate base rate of return formula.

The second criterion established was that the rate of return should not result in the confiscation of the firm's capital. Since the funds flow model is built on the principle of maintaining the investors' financial capital, this criterion is closely related to the fifth criterion. It states that the rate of return should be sufficient to maintain the financial integrity of the firm. The funds flow model is designed to measure the minimum earnings level necessary to meet these tests.

The relationship between the rate of return allowed and operating efficiency alluded to in the third criteria is just as perplexing an issue for the funds flow model as it is for the rate base-rate of return formula. If the regulator believes that a higher rate of return would encourage efficiency, the allowed return could be set at a higher level. There is another side of this argument, That is, the apparent low rates of return generated using the funds flow model and the concern with possible circularity in the model could discourage investors and lead to losses in efficiency[8].

If the market value of the railway were known it would be relatively easy to demonstrate that the earnings requirements generated by the funds flow model are in line with investor expectations. However, when these required earnings levels are combined with an overstated asset base the result is a lower rate of return than the rate base rate of return formula. It is argued that this low rate of return discourages efficiency by discouraging investment. Earlier in this paper it was shown that the U.S. security markets adjust for this by placing a lower market value on rail equity than its book value. Thus the market has adjusted the asset base value to reflect the earning power of the assets. So long as those who buy rail equities are secure in the knowledge that variations in rail earnings are due to underlying economic conditions and not external events such a change in the regulatory policy, there is no need to offer a higher rate of return in order to attract capital. In those cases where the market value is below book value, allowing a rate of return on the book value would provide existing stockholders with a large capital gain as the market value is driven up toward book value. Furthermore, to do this is tantamount to guaranteeing present stockholders a particular level of stock prices. This is basically the public utility approach which has been previously shown to be of questionable applicability to Canadian railways.

The main criticism of the funds flow model which led to its rejection at the 1969 Cost Inquiry[29] was that it was circular. That is, a railway which experiences a high rate of return will be assigned a high cost of capital than a less profitable railway. To the extent these rates of return affect subsidies and rate levels they could become "self-fulfilling", a result which was not considered to be in the public interest because it would discourage investment. This argument ignores three very fundamental aspects of the funds flow model when applied to Canadian railways. The first point is that the rates of return estimated by the model will rise over time as unproductive assets are removed from the asset base and replaced by assets which earn a return at least as great as the cost of capital. The second point is that the rate of return estimated is the minimum required. As such, a regulator could, with justification, set the target return slightly higher. Finally, since the subsidized services are less than 25 per cent of railway earnings, the primary determinant of railway performance is outside the regulator's influence and in the market place.

The fourth criteria identified to be used to evaluate measures of the fair rate of return states that it should allow sufficient earnings for the company to continue to attract capital to expand but should not encourage uneconomic investment as a means for expanding the asset base. By only allowing a return on new investment equal to the marginal cost of capital it could be argued that such a return may not be sufficient to attract capital. It has already been mentioned that this could be accommodated by allowing a return greater than the cost of capital and using a multi-period model. However, too high a return can lead to over capitalization of the railway. To resolve this requires a judgment decision which takes into account the competitive environment of the railway and the purpose of the various regulatory provisions. In this situation the funds flow model is in a much better position to offer useful information than the rate base rate of return formula. If, in fact, the net book value overstates the asset base, the existing procedure could contribute to an over-capitalization of the railways.

The final two criteria identified relate to the comparable earnings standard and compensation for the risk assumed. Since these have already been discussed in the previous section, they will not be addressed here.

Another aspect of the rate of return generated by the funds flow model is its applicability to the various regulatory provisions applied to the railway. The relevant regulations were described in Chapter IV and need only be grouped into three types for purposes of this discussion. The first group are those regulations which govern the abandonment of branch line or passenger services. In these situations the current costing practice of using the lesser of salvage or net book value to measure the value of those assets which can be specifically identified with the services should be continued. Where such a value is used the proper cost of capital is the current market rate found using conventional techniques such as the CAPM or DCF models. However, a large part of the capital costs are associated with assets which cannot be specifically identified with the service. The cost of capital on these assets is determined using the variable component of net book value multiplied by the CTC approved cost of capital rate. To the extent the asset base is overstated, some services could be found uneconomic which would, with the use of the funds flow analysis, otherwise be viewed as making a contribution to the overall profitability of the railway.

The second group of regulations includes the subsidies paid on grain, branch lines, Maritime Freight Rates Act and passenger services. Today the cost of these subsidies is about $1.5 billion per year. Of this $250 to $300 million dollars is paid out in respect of the cost of capital. Any overstatement of the asset base has a significant impact on the cost to the tax payer and to railway profitability.

The final group of regulations are those which influence rate setting. First consider the minimum rate. An overstatement of the asset base and resulting cost of capital could cause the railway to turn down traffic which might have made a contribution to railway profitability. The rate ceiling set by the maximum rate rule would decline if the CTC approval cost of capital were lowered. However, as it is now written, the ceiling is so high relative to rates charged that no impact would be felt. Similarly, there would be little impact on Section 23 cases. These cases focus on the rate level relative to the market characteristics of the product being transported. It is important to note that Canadian regulation is based on the measurement of variable costs. Thus it is imperative that as accurate a measure of costs as possible is available to regulators.

Under the Staggers Act[160], the Americans take a different approach to regulating railway rates. For the most part rates are not regulated unless the railway is deemed to be revenue adequate. The Act did not define 'revenue adequacy' and left this task up to the ICC. It has already been noted that the ICC rejected the funds flow model as the measure of 'revenue adequacy' on the grounds that it results in a rate of return which was too low to ensure the long term viability of the railways. The use of the funds flow model would have resulted in a number of railways being considered 'revenue adequate' even though their market values were considerably lower than net book value. Arguing that the railways should be allowed to earn a return which is at least equal to the cost of capital on net book value, the ICC opted to use the conventional rate base rate of return formula. Rightly or wrongly the ICC's rejection of the funds flow model was motivated by a desire to allow American railways maximum rate setting freedom. As has already been pointed out the Canadian regulatory environment is more oriented to individual rate cases and subsidized services and does not directly concern itself with overall 'revenue adequacy'.

It is quite clear that an error in setting the allowed rate of return can have significant impact on investors, users and tax payers. In view of the information presented, the assumption that the book value is good proxy for the market value of the assets needs to be seriously questioned. Railways, not being like public utilities except in the instance of some subsidized services, should not use the rate base-rate of return formula without examining the valuation of the asset base.

Before leaving the area of fair rate of return there are two criticisms of the funds flow model which were raised during the CTC Rail Costing Study[28,Volume II] which should be considered. The first of these was:

> One difficulty (with the funds flow approach) that may arise is the possible emergence of a view of the requirements calculation as a form of regulatory profit control. Such a view would be most unfortunate, as it would undermine the current regulatory environment which promotes rate making flexibility and corporate innovation.

This criticism ignores the purpose of the funds flow model which is to identify the sums of money needed to maintain the financial integrity of railroad investors. There are no significant impediments in the regulation which prevents the railways from maximizing their profit from unregulated services. With regards to the regulated functions it is the regulation itself which sets the allowed revenue levels by determining the contribution to overhead (fixed costs) the railways are allowed. The above statement is a criticism of regulation, not of the funds flow approach per se.

The second criticism contained in the CTC report is given below:

> A related problem is that where the market value of the firm is low, it may be so because public obligations prevent the company (and investors) from recovering the market value of tangible assets used in unprofitable services. The question can then be asked whether the overall returns measured (which are an average over profitable and unprofitable activities) adequately reflect the cost of capital for ongoing activities, including public obligations.

The main concern here was the Statutory grain rates which were given considerable attention in developing the model. Again this criticism stems from a misunderstanding of the basic principles underlying the funds flow model. The above statement ignores the fact that the market factors such circumstances into returns required from the firm. It was only the impending resolution of the Statutory rate issue which motivated it being included in the sensitivity analysis performed on the model.

From the perspective of the fair rate of return, the funds flow model contributes useful information about minimum required levels of return for companies whose assets are overvalued on their books. The model is theoretically sound and, in the situations where the asset base is over valued, is superior to the rate base rate of return. All this is said with one serious caveat in mind. In presenting the fair rate of return concept it was described as being a rate greater than or equal to the cost of capital. Therefore, the concerns expressed in the previous section about the funds flow model as a measure of the cost of capital have to be considered here also. The net affect is to say, at the minimum, that caution should be exercised in using the funds flow model in the process of setting the fair rate of return. Definitely, the model should not be used in isolation from the more convention rate base-rate of return funds.

3. THE FUNDS FLOW MODEL AND THE RESOLUTION OF COST OF CAPITAL ISSUES

The issue where the funds flow analysis makes the greatest contribution is in the thirty year old debate over the valuation of the asset base. It is the model's ability to separate itself from the problems of asset valuation which makes it a potentially valuable source of information. This is especially true for Canadian railways which are divisions of their respective corporate entities. For CN Rail there is an additional advantage because of the incompleteness of its property account records. Not all asset base problems are eliminated by the funds flow model. The net book values still have to be used for costing purposes.

In Chapter IV and to a lesser extent in Chapter VI a number of the current issues associated with the CTC's cost of capital methodology were raised. These included problems such as the measurement of the current cost of equity, the determination of the appropriate capital structure, the proper tax rate, the setting of the cost of deferred taxes, the treatment of donations and grants and the adjustments to account for the risks of different services. None of these disappear with the funds flow model, they just diminish in importance. The sensitivity tests in Chapter VI included an assessment of the impact of changes to three of the more significant issues which arise in conjunction with the rate base-rate of return formula. None of these, the tax rate, the change in the cost of equity and the capital structure, had a major impact on CP Rail's results. In CN Rail's analysis more sensitivity was detected but this was primarily due to the extreme change in input values which had to be made.

Some new issues created by the funds flow model arise mainly out of the assumptions used to construct it. These are discussed next.

4. THE VALIDITY OF THE FUNDS FLOW ASSUMPTIONS

As the theoretical assumptions have already been discussed the attention here is focused on the assumptions used to construct the model. For the most part they are reasonable. However, there are some concerns which need to be expressed.

The first concerns the timing of the cash inflows and cash outflows. An improvement could be made to the model if the sources of funds, other than net income (depreciation, deferred taxes, other income) were forecasted as opposed to being held at the base year level. The affect of this is to overstate the capital required. With increasing investment, sources of funds, such as depreciation and deferred taxed, will grow from year to year. Increases in these sources of funds will reduce the need for additional debt and equity.

When the funds flow model was set up by the Interstate Commerce Commission they designed it as a projection of the amount of capital required by the railway industry. In order to be able to compare the results computed using the funds flow model with the conventional market based models, an effort was made to simulate investors' expectations. By assuming investors had perfect knowledge, the actual cost of the capital program in the forecast year was used. This was done based on the efficient markets hypothesis but without any empirical evidence to support the contention that investors are fully knowledgeable about capital plans of the railways. This is a tenuous assumption because it is extremely difficult to project the amount of capital required to accommodate increased traffic and to replace existing facilities. The complexity arises out of the ability of the railways to alter operating procedures to increase capacity and not always rely on additional investment. Even though the investor only has to anticipate the amount the total capital program, this can still be quite difficult.

In computing the cost of new capital. the CTC determined cost of capital rate were used. The procedures used by the CTC were severely questioned during the CTC Cost of Capital Review which was completed in February of 1985[9]. Since a decision has not yet been issued, the figures were taken as given. Any further research in this area should benefit by having the decision in this case available.

The projection of the base year's net income into the forecast period gives rise to two interesting issues. They are related to the problem of using one year's income as the basis for projecting the required net income in the forecast period. The first arises when there is a loss in the base year such as occurred with CN Rail in the 1977 projection. In constructing the model it is assumed that investors do not invest to lose money. To use the reported net income is to assume that investors do not anticipate greater losses in the future. In footnote to the CN computation the impact of assuming a zero profit in 1977 was included to illustrate an alternative treatment of this issue. By putting in a zero net income it is possible to estimate the return required to turn around the company's losses. The second issue concerns the inclusion of other income as a source of funds. These funds arise out of the sale of property and salvage. It could be argued that these are "wind falls" to the equity holder and should play no part of a revenue adequacy determination. Nevertheless, they are a relatively large and important source of funds for railways. Thus it has to be expected that investors count on these as sources of funds to the railway.

The ICC funds flow model was designed to be used by cash deficient railways. It did not contemplate a railway having a positive cash balance after all capital expenditures and dividend payments. The same situation was expected in Canada. However, it turned out that in over half of the years studied for CP Rail positive cash balances existed. If these funds were used for capital investments, in lieu of using debt as the model computes, all the assumptions regarding the financing of new capital would have to be adjusted.[10] The other possibility, which essentially creates the same problem, is that the funds would be used for debt retirement. There needs to be a major modification to the model to accommodate this situation.

One final area where some concern regarding the assumptions needs to be expressed is the computation of the cost of "rolling-over" debt. This computation is strongly influenced by the allocation formula used to assign debt to the rail division. This formula causes debt to appear and disappear from the capital structure. As a result some of the debt thought to be retired is in reality just assigned back to the parent company. For purposes of this analysis, the capital structure was taken as given. If the CTC were to set a deemed or notional capital structure this problem would disappear.

The difficulties cited above are not fatal to the funds flow model. In fact, most of them could be resolved by having access to better and more complete data. Most of the information required should be available to the CTC.

5. FUNDS FLOW IMPLEMENTATION AND RESULTS

The last two criteria are considered together. From the analysis presented in this study and the U.S. funds flow computations it is quite clear that the model can be implemented with relative ease once the data is assembled. Since the model requires data over and above what is required to implement the rate base-rate of return formula, it does impose a greater burden on the railway and the regulator. Given the potential ramifications of an over statement of the asset base, it certainly appears that the additional effort would be beneficial.

Based on the few years for which computations were done it appears that the model does produce the results which would be expected with an overvalued asset base. Also, subject to the reservations already expressed, the results tend to follow the expected pattern set by the market cost of capital rate. Furthermore, the funds flow results are closer to the returns actually earned by the railways during this time period.

There are a few observations about the implementation and results of the model which require some discussion. The first is that the model, if implemented for regulatory purposes, is subject to abuse. It is extremely difficult to assess a proposed level of capital spending which would be required to implement the model from year to year. The problem with a post-audit is it is always difficult to get money back that someone else has already spent[11].

From a regulatory and policy perspective, the funds flow model has a number of other uses. In addition to its applications in rate of return computations, the model is potentially useful for assessing the impacts of various policies on the railways. It also becomes possible to study the financial implications of various levels of spending programs proposed by the railways.

6. CONCLUSIONS

At the start of this paper it was observed that a large discrepancy existed between the rates of return reported by Canada's two trans-continental railways and their claimed cost of capital. It was then observed that despite these apparently low reported rates of return, the railways continued to raise debt capital and invest in the rail plant. The task undertaken in this paper was to determine how this apparent contradiction occurs and whether the cause is taken into consideration by railway regulators and policy makers. It is the thesis of this paper that current procedures for estimating the fair rate of return are not, in themselves, sufficient to resolve this inconsistency. In addition, the concept of the funds flow model was put forward as a possible approach to resolving the problem.

Based on a careful examination of the relevant finance and regulation theory as well as the available data it is concluded that it is an overstatement of the asset base used in the rate base-rate of return formula used by the Canadian Transport Commission which leads to required earnings levels well in excess of reported industry results. From the information gathered it was found that the Canadian Transport Commission is for the most part using state-of-the-art market based estimating techniques to compute the cost of capital rate. This market based rate is then applied to the net book value of the assets to compute the required level of earnings. Implicit in this action is an assumption that the book and market value of the assets are approximately equivalent. It was then demonstrated that while such a condition is possible for public utilities, it is extremely unlikely for railroads. Based on an examination of railway earnings levels it was concluded that the market value of the railways' assets is below net book value.

The approach put forward to address this problem was the funds flow model. With some reservations, it is concluded that the funds flow model could contribute needed information to decision makers charged with the responsibility of setting annual rates of return for regulated companies with overstated (from an economic perspective) asset values. In general the reservations expressed concern the need for the additional research which will be suggested at the end of the paper.

The funds flow model is desirable because it is able to neutralize the asset base valuation question by directly measuring the earnings required to meet the following three criteria:

a. To provide a return on existing investment at the base year level and to make new investments profitable.

b. To provide adequate fixed charge coverage.

c. To provide required equity capital from retained earnings.

Criterion I is of particular significance because it provides the regulator with the minimum level of earnings necessary to maintain the financial capital of railway investors. Criteria II and III provide additional information to the regulator in that they reflect other standards of revenue adequacy.

While the model does seem to meet most of the criteria identified to assess it as a measure of the cost of capital and fair rate of return, some problems remain. These range from the very serious to those requiring technical changes to the model. Since the latter problems can be resolved they need not be cause for concern. The one major difficulty identified arises out of the fact that the model has not been subjected to a rigorous empirical test of its ability to explain the structure of the capital markets. This is critical since the rate of return needs to be tied to the cost of capital. Such tests are difficult because the cost of capital is not a known value, it is a tautology.

It is not proposed that the funds flow model replace the rate base rate of return formula. The two methods compliment each other in that the funds flow model can be considered the floor and the rate base-rate of return the ceiling. In addition to neutralizing the asset base as an issue, the funds flow model demonstrated some other advantage. One of its more desirable features is that it is forward looking and need not be tied to the past as are some of the conventional cost of capital estimating techniques. The model is also less sensitive to such difficult issues as the appropriate capital structure, tax rate, and return on deferred tax balances than the rate base-rate of return formula.

In conclusion the funds flow model appears to be conceptually sound and potentially useful to the regulators of Canada's railroads. There are millions of dollars at stake. Consequently, additional research into the funds flow model is both necessary and warranted. The final section conveys some ideas for additional research.

6.1. AREAS FOR ADDITIONAL RESEARCH:

The most pressing need is to conduct a study using the funds flow model on a large sample of non-regulated companies for which market valuation can be observed. A longer time horizon should be chosen in order to separate the affects of inflation, capital expansion and net income. Further refinements to the model to accommodate debt retirement, to get a better base year estimate of net income, and to forecast other sources of funds would be required. Because the model estimates the minimum earnings requirements, the market value of a firm computed using the funds flow model should be less than what is observed.

Other areas where research would be beneficial include the expansion into a multi-period model. Also there is a need for additional information on whether investors formulate expectations on cash flows and capital spending plans.

ENDNOTES

1. There were a few years in CP Rail's case where there was excess capital available. See Appendix III, Table A-III 4.

2. This can be quite difficult. The annual data would have to be converted to the base year equivalent using an index. For reasons already discussed, this index presents some difficulties in computation if an index of railway rates is required.

3. One possible explanation is based on the demand for transportation being derived from the general level of economic activity in the world. During the boom period demand for transportation grew rapidly forcing the railways to invest despite the high cost of capital.

4. The marginal cost of debt and equity applied to the cost of new investments includes the risk premium attached to the income stream from the firm. This gives the required earnings necessary to maintain the financial capital of the investor.

5. The reproduction costs, general price level adjustment and current cost approaches focus on restating the value of current assets to reflect the effects of inflation.

6. The results of the required earnings to provide adequate fixed cost coverage were clouded by the "zero" tax rate used. However, when this was adjusted for in the sensitivity tests the required returns were still very high.

7. The exceptions are those assets which can be specifically identified with a service whose value is set at net salvage.

8. The low rates of return generated by the funds flow model could also discourage investors which are not familiar with the approach.

9. The range of values given by the various parties to the Cost of Capital Hearing were ± 5% on the CTC estimates.

10. To do this would require an assumption that the railway desires to become more equity intensive. While this might be logical for CN Rail, they are not in a financial position to do so. CP Rail, who is in a position to do this, already has a relatively low debt ratio.

11. A series of monthly payments of the subsidy would help resolve this.

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APPENDIX I

CAPITAL MAINTENANCE

MAINTENANCE OF FINANCIAL CAPITAL

The goal of maintaining financial capital can be illustrated through the following simple example.[1] Assume that an investment consists of a machine costing $100 with a service life of four years with no salvage value at the end of year four. Also assume that the investment is financed by equity and there are no income taxes. From the market place the current cost of equity is 15.5 per cent and expected inflation is 10 per cent at the time of investment. Factoring out the inflation, the real cost of equity is 5 per cent.[2] In order to maintain financial capital using the original cost base the annual cash flows are set equal to the sum of the annual depreciation and a return on the net investment base (original cost minus accumulated depreciation). Table A-I 1 demonstrates that the net present values of the cash flow stream is equal to the original investment.

Alternatively the maintenance of financial capital can be shown using current value adjustments to the asset base adjusted for remaining service life. In Table A-II 2 annual cash flows are the same depreciation indexed for inflation and the real rate of return on the adjusted net investment. Since the cash flows generated have an opportunity cost of 15.5% in the marketplace, this rate is the appropriate discount rate to be used on the cash flows:

TABLE A-I 1

Maintenance of Financial Capital

Original Cost Base

Year	1	2	3	4
	($)	($)	($)	($)
1. Investment Base	100	75	50	25
2. Depreciation [100/4]	25	25	25	25
3. Return on investmment @15.5%	15.5	11.625	7.75	3.875
4. Cash Flow (2+3)	40.50	36.625	32.75	28.875
5. Present Value of Cash Flow @15.5%	35.06	27.45	21.25	16.32

Sum of Present Values = $100

TABLE A-I 2

Maintenance of Financial Capital

Current Value Approach*

Year	1 ($)	2 ($)	3 ($)	4 ($)
1. Investment Base	110	90.75**	66.55	36.6025
2. Depreciation	27.50	30.25***	33.275	36.6025
3. Return on Investment @5%	5.50	4.5375	3.3275	1.830
4. Cash Flow (2+3)	33.00	34.7875	36.6025	38.4325
5. Present Value of Cash Flow @15.5%	28.5714	26.077	23.755	21.595

Sum of Present Values = $100

* This is a single indexing approach to current value

** 90.75 = 75(1+.10)(1+.10)

*** 30.25 = 25(1+.10)(1+.10)

In both these examples it can be seen that the investor remains whole. At the end of the year four, if everything went as expected, the investor has the principle and a return on the capital employed. The difference between the two examples is simply the manner in which inflation is accounted for. It does not change the investor's decision to undertake the project.

MAINTENANCE OF PHYSICAL CAPITAL

To illustrate this approach consider the example developed in Table A-I 2. As in the example, at the time funds were committed to the project, inflation was expected to be 10 per cent. Now assume that the actual inflation turned out to be 12 per cent causing the the market cost of capital to rise to 17.6%. In order to maintain physical capital the company will require 157.35[3] at the end of year four. Table A-I 3 demonstrates that this can be achieved by adjusting the asset base upward to reflect its current value. In this example the adjustment was made in year one but could have been made in any subsequent year. One other point to notice is that the real rate of return did not change from the 5 per cent level. This is based on an assumption that the company is in a position to pass on to customers higher costs caused by inflation. Under these conditions the market value of the firm's equity would rise to reflect the increase of the value of the assets. Consequently, the firm must increase the dollar value of its return to equity in order to ensure investors receive the 5 per cent real rate of return they are demanding.

TABLE A-I 3

Maintenance of Physical Capital

Year	1	2	3	4
1. Investment Base*	112.000	94.080	70.246	39.338
2. Price Level Adjusted Depreciation	28.000	31.360	35.123	39.338
3. Real Return on Investment @5%	5.600	4.704	3.513	1.967
4. Cash Flow (2+3)	33.600	36.064	38.636	41.305
5. Dividends**	5.600	6.272	7.025	7.868
6. Retained Cash for Reinvestment (4)-(5)	28.00	29.792	31.611	33.437
7. Future Value of Retained Cash Flow @17.6%	45.539	41.202	37.175	33.437

Sum of Future Values $157.35

* asset based adjusted for new rate of inflation e.g. in year 2 $94.080=75(1+.12)^2$

** the stream of dividends pays the investor 5% in the first year and an equal value in real terms in the following years e.g. in year 2 $6.272=5.6(1+.12)$

*** this is the rate which could be earned on funds in the marketplace.

REINVESTMENT DECISION

At the time of reinvestment, the two approaches yield the amounts of funds available for reinvestment if actual inflation was as expected when the investment was undertaken. However, when inflation differs from expectations, the results vary. The case where actual inflation was 12 per cent as oppposed to the expected of 10 per cent.

Financial Capital:

From the preceding example, if any amount equal to the real rate of return were paid out in dividends and the remaining sum invested at 15.5 per cent there would be $146.41 available at the end of year four. This would exactly replace the asset if its value had risen at the rate of inflation. Consider what happens if inflation was 12 per cent over the period instead of 10 per cent. It would now cost $157.35 to replace the asset or $10.94 more than is available. The reinvestment is a separate investment decision for which the investor will expect both the repayment of his investment ($157.35) and a 17.6 per cent rate of return.[4]

Physical Capital:

In the case of the example, the investor entered into the project expecting 10 per cent inflation and a 5% real rate of return. Despite the jump in inflation to 12 per cent, the investor still receives his 5 per cent real rate of return. In addition, he has $157.35 available to replace the asset.

If the asset is replaced at the end of year four for $157.35 the depreciation for the next year would be $39.338 and the return on investment would be $7.868. These are the same values found for year four under depreciation and dividend pay-out.

ENDNOTES

1. The examples are based on those presented in: Governments of the Provinces, [111,Vol.I,pp18-21].

2. The real rate of interest (r) is found by solving the following equation.

   $r=(1+R)/(1+P)-1$

   where:
   R= current market rate and
   P= the expected rate of inflation

3. $100(1+.12)^4=157.35$

4. From before $R=(1+r)(1+p)$; $17.6=(1.+.05)(1+.12)$

APPENDIX II

INTERSTATE COMMERCE COMMISSION'S

FUNDS FLOW PROJECTION FORMAT

This appendix contains the algorithm used by the Interstate Commerce Commission in conditioning to funds flow analysis for 1978[73,pp285-290]. For the most part the model is self explanatory. However, some of the sources of information require some brief explanation. This is given below by referring to the specific line numbers in the model. The primary source of data is Schedule A. This is a list of data which the ICC, in Ex Parte 338[72], required the railways to submit annually for purposes of revenue adequacy determination.

Line 2: The ICC, for reasons discussed in this report, chose to use a target level of capital expenditures which reflected the ICC's estimate of the amount of capital required by the industry.

Line 6: The ICC set a target 40:60 debt to equity ratio for all class I railroads.

Line 8
and 22: These are contained in the ICC's cost of capital determination for 1978.

Line 11: The ICC assumed that debt would mature at a constant rate over the five years for which projects were made.

Line 16: This is after tax net income.

Line 23: ".1116" is the after tax weighted average cost of capital.

Line 25: The ICC used 3.5 times earnings.

Line 27: The tax rate is the sum of taxes paid plus deferred taxes divided by earnings after fixed charges.

Line 32: Dr. Foster's studies examined the expected dividend yields on new investment.

Line 35: The last term in this computation (-Schedule A, line 11c) are the deferred taxes.

APPENDIX D

Computation schedule for funds flow projection format

I. FIXED CHARGES

Item	*Source*
1. Net inevestment in road and equipment for previous year	First year: schedule A, line 20b. Later years: preceding year's lines 1 + 2 - 4.
2. Expenditure for plant and equipment this year	Specified investment assumption.
3. Average depreciation rate	Schedule I, line 4 (including Conrail) ÷ schedule A, line 21a (assumed constant).
4. Depreciation charges for current year	Line 3 x (line 1 + line 2).
5. New capital required this year	Line 2 - line 4.
6. Debt ratio	Found in this proceeding.
7. Amount of new debt capital required	Line 6 x line 5.
8. Current cost of debt	Found in this proceeding.
9. Fixed charges incurred on new debt capital	Line 8 x line 7.
10. Previous year's fixed charges	First year: schedule A, line 8. Later years: preceding year's line 15 below.
11. Long-term debt due within 1 year	Schedule A, line 4 (assumed constant).
12. Previous year's long-term debt due after 1 year	First year: schedule A, line 5. Later years: preceding year's lines 12 + 7.
13. Average interest cost on existing debt	Line 10 ÷ (line 11 + line 12).
14. Additional fixed charges incurred on "rolled over" debt	(Line 8 - line 13) x line 11.
15. This year's total fixed charges	Line 14 + line 10 + line 9.

Computation schedule for funds flow projection format—Continued

II. NET INCOME

A. To provide a return on existing investment at the 1977 level, and to make new investment profitable

Item	*Source*
16. Previous year's net income	First year: schedule A, line 1. Later years: preceding year's line 24.
17. Equity ratio	Line 1 - line 6.
18. New equity capital required this year	Line 17 x line 5.
19. Previous year's stockholders' equity	First year: schedule A, line 17. Later years: preceding years' lines 18 + 19.
20. Previous year's rate of return on total capitalization	(Line 16 + line 10) ÷ (line 12 + line 19).
21. Assumed earnings reduction from depreciation of old investment	Line 20 x line 4.
22. Cost of equity capital	Found in this proceeding.
23. Required earnings on new investment	(Line 18 x line 22) + (line 4 x 0.1116).
24. Net income required to make new investment profitable	Line 23 - line 21 + line 16.

B. To provide adequate fixed charge coverage

25. Adequate fixed charge coverage (times)	Assumed adequate coverage ratio.
26. Adequate income available for fixed charges	Line 25 x line 15.
27. Tax rate	Schedule A, lines (11b + 11c) ÷ (7 - 8).
28. Net income consistent with adequate fixed charge coverage	(Line 1 - line 27) x (line 26 - line 15).

C. To provide required equity capital from retained earnings

29. Previous year's dividends	First year: schedule A, line 18. Later years: preceding year's line 34.
30. Dividend yield on book value of old investment	Line 29 ÷ line 19.
31. Assumed dividend reduction from depreciation of old investment	Line 30 x line 4.

Computation schedule for funds flow projection format—Continued

II. NET INCOME—Continued

C. *To provide required equity capital from retained earnings*—Continued

Item	Source
32. Required dividend yield on new equity investment	From Dr. Foster's market value studies in this proceeding.
33. Required dividends on new equity investment	Line 32 x (line 18 + line 4).
34. Total required dividends for current year	Line 33 - line 31 + line 29.
35. New income sufficient to provide required equity capital from retained earnings	Line 34 + line 18 - schedule A, line 11c.
III. RETURN ON TOTAL CAPITALIZATION	
36. Total capitalization	Line 19 + line 18 + line 12 + line 7.
37. Return on total capitalization to maintain the return on existing investment at the 1977 level, and to make new investment profitable	(Line 24 + line 15) ÷ line 36.
38. Return on total capitalization to provide adequate fixed charge coverage	(Line 28 + line 15) ÷ line 36.
39. Return on total capitalization to provide required equity capital from retained earnings	(Line 35 + line 15) ÷ line 36.

APPENDIX E

Narrative description of funds flow projection format

The funds flow projection format set forth in appendix D permits a projection of the required return on total capitalization at a given investment level, using three different net income objectives. The projections are made on a *pro forma* basis, using a 1977 base year. In other words, they begin with 1977 operating results and show how these results would change over a period of years if the specified objectives were to be satisfied.

The three net income objectives result in three corresponding sets of assumptions, as follows:

Objective A.—Investment in plant and equipment that is carried over from 1977 is assumed to earn the same rate of return that it earned in 1977. Investment made after 1977 is assumed to be "profitable," that is, to earn a rate of return equal to the current cost of capital.

Objective B.—Earnings in 1978 and later years are assumed sufficient to provide adequate coverage of fixed charges.

Objective C.—Earnings retained in 1978 and later years are assumed sufficient, when combined with depreciation and deferred tax funds, to provide the funds required for new equity investment.

For each of the three objectives, the amount of new investment is the same, and its financing from debt and equity sources occurs in the same proportions as the 40/60 capital structure ratio found in this proceeding. For the first two objectives, it is assumed that the new equity investment can be financed, to the extent necessary, from equity capital obtained from outside the company. For the third objective, all new equity capital is assumed to be generated internally.

The ultimate products of this procedure are three sets of return on total capitalization figures, found at lines 37, 38, and 39. The derivation of each of these lines will be discussed in turn.

LINE 37

Line 37 shows the return on total capitalization required in order to maintain the return on existing investment at the 1977 level, and to make new investment profitable. Return on total capitalization is the sum of fixed charges and net income, divided by total capitalization.

Fixed charges (interest expenses) for this objective (and for the other two objectives as well) consist of three elements. The first is a continuation of the level of fixed charges incurred the previous year. This level continues because (with one exception, to be discussed below) the carrier continues to have the same debt obligations it had the previous year. The one exception is that some debt is "rolled over," that is, paid off but reborrowed at current interest rates. For the rolled-over debt, the difference between interest expenses at the old and new interest rates becomes an addition to the fixed charge total. This addition is the second of the three elements in the fixed charge computation.

The third element comprises the fixed charges incurred on new debt capital. In order to arrive at this figure, one begins with a given amount for new expenditure on plant and equipment. Since part of this expenditure can be financed with funds made available through current depreciation charges, the amount of current depreciation is subtracted from the amount of new expenditure. The remainder is the amount of new capital that must be raised to finance the new expenditure. Since the 40/60 debt ratio is maintained in this procedure, the amount of new debt capital required is the product of the debt ratio and the total amount of new capital to be invested. This new debt amount is multiplied by the current interest rate to find the fixed charges incurred on new debt capital. Adding this element to the previous two reveals the total fixed charges to be incurred for the year.

Net income for this objective is also composed of three elements. The first is an amount equal to the previous year's net income. Since the rate of return on existing equity capital is to continue unchanged for this objective, the amount of net income received the previous year will be received again. The one exception here is that a certain amount of existing capital will be withdrawn in the form of depreciation charges, and then reinvested. The withdrawal creates a reduction in the amount of total net income, found by multiplying the depreciation charges by the previous year's rate of return on total capitalization. This reduction is the second of the three net income elements.

The third net income element incorporates earnings on new equity capital and earnings on reinvested depreciation funds. We find the amount of new equity capital by multiplying the total new capital required by the carrier's equity ratio. In order to make new equity investment acceptably profitable, the carrier must earn a rate of return on it equal to the current cost of equity capital. Therefore the amount of new equity capital is multiplied by the current cost of equity capital. The other part of this element, reinvested depreciation funds, earns the composite current cost of capital. Earnings on new equity capital and earnings on reinvested depreciation funds constitute the required earnings on new investment, which are added to the previous two net income elements to find the total amount of new income required.

Total capitalization consists of the carriers' debt and equity capital. We find it by adding four elements: (1) the previous year's long-term debt due after 1 year; (2) the amount of new debt capital required this year; (3) the previous year's stockholders' equity; and (4) the new equity capital required this year. By adding fixed charges and net income, and dividing this sum by the total capitalization, we find the return on total capitalization.

LINE 38

Line 38 shows the return on total capitalization required in order to provide adequate fixed charge coverage. Because the amount of debt and equity investment are the same as for the previous objective, the same fixed charge and total capitalization figures are used. Only the net income figure is different.

The *net income* objective here is to have a level of return that is consistent with adequate fixed charge coverage. What we mean by fixed charge coverage is the ratio of income available for fixed charges to the amount of the fixed charges. In order to find an adequate income available for fixed charges, we multiply the amount of the fixed charges by the desired coverage ratio. To progress to the net income level, we subtract fixed charges from the adequate level of income available for fixed charges, and reduce the remainder to an after-tax figure.

As before, this net income is added to the fixed charge figure, and the sum is divided by the total capitalization, to find the return on total capitalization. So long as the resulting figure exceeds the figure on line 37, it will also be sufficient to make new investment profitable.

LINE 39

Line 39 shows the return on total capitalization that would be sufficient to permit the required new equity investment to be made from funds provided by retained earnings. As with the previous objective, the fixed charge and total capitalization figures are the same as previously calculated. Only the net income figure requires a new computation.

To find the *net income* that would be sufficient to provide required equity capital, we begin with the sum of required new equity capital and required dividends, since these are the two elements to which net income must be applied. The figure for required new equity capital is taken from the computation for the first objective.

The required dividends for the current year include three elements. The first is a continuation of the previous year's dividend level on existing investment. The second is an amount to be subtracted from the previous year's dividend level because of the depreciation of existing investment. The third is an additional amount of dividends to be paid on new equity investment. The amount of these new dividends is computed from the dividend yield rate shown in the cost-of-capital studies in this proceeding.

From the sum of required new equity capital and required dividends, we subtract funds available from the provision for deferred taxes, in an amount assumed to be constant at the 1977 level shown in schedule A. The difference is the required net income. It is added to the fixed charges, and the sum is divided by total capitalization to find the return on total capitalization for this objective. Again, so long as the figure exceeds the amount shown on line 37, it will also be sufficient to make new investment profitable.

NATURE OF FIGURES PRODUCED

The desired computations may be carried out for any number of successive years. The result would be a set of figures showing both the level and the trend of earnings over a period of years for each of the three objectives. Similar computations may be performed with differing assumptions as to the desired level of yearly expenditure for plant and investment.

These are not forecasts, since they make no attempt to take account of possible future changes in economic conditions. Rather, as previously noted, they show how the actual 1977 operating results would change over a period of years if the specified objectives were to be satisfied.

APPENDIX III

CP RAIL: FUNDS FLOW ANALYSIS

INTRODUCTION

This appendix contains the detailed funds flow computation for CP Rail. It starts with the algorithm for the funds flow model which was explained in some detail in Chapter VI. By following the algorithm the reader can identify the connections between the main part of the model and the supporting tables.

The second part of the appendix gives the results of the funds flow analysis for the years 1977 to 1982 and provides supporting tables. Each table is accompanied by a short write-up identifying the purpose of the table, the sources of data, and explanations where necessary.

TABLE A-III 1
FUNDS FLOW ANALYSIS
ALGORITHM

	FORMULAS
ASSET BASE	
1. Net Investment in Road and Equipment Property at End of Base Year	TABLE 3
SOURCES OF FUNDS (Excluding Net Income)	
2. Depreciation	TABLE 4
3. Deferred Income Taxes	TABLE 4
4. Salvage	TABLE 4
5. Sale of Property	TABLE 4
6. Total	SUM(L2,L3,L4,L5)
APPLICATION OF FUNDS (Excluding Capital Additions)	
7. Redemption-Preferred shares	TABLE 5
8. Total	SUM(L7)
9. Net Funds Available for Capital Additions	L6-L8
CAPITAL ADDITIONS	
10. Projected Investment	TABLE 4
11. New Capital Required	L10-L9
DEBT AND PREFERRED STOCK FINANCING	
12. Debt Outstanding	TABLE 3
13. Marginal Debt Ratio	TABLE 7
14. Marginal Preferred Stock Ratio	TABLE 7
15. New Debt Required	L13*L11
16. Marginal Cost of Debt	TABLE 7
17. Embedded Cost of Debt	TABLE 7
18. Fixed Charges on New Debt	L15*L16
19. Previous Year's Fixed Charges	L12*L17
20. Interest Savings Due to Recapitalization (CN only)	TABLE 8
21. Debt Due in One Year	TABLE 8
22. Total Cost-Roll-Over Debt	TABLE 8
23. Total Fixed Charges	L18+L19+L22-L20
24. Required Preferred and Preference Dividends	TABLE 6

TABLE A-III 1(con't)

	FORMULAS
EQUITY FINANCING	
25. Book Value of Equity	TABLE 3
26. New Equity Ratio	TABLE 7
27. New Equity Required	L11*L26
EARNINGS REQUIRED TO PROVIDE A RETURN ON EXISTING INVESTMENT AT THE BASE YEAR LEVEL AND TO MAKE NEW INVESTMENTS PROFITABLE	
28. Previous Years' Net Income	TABLE 4
29. Previous Years' Return on Net Investment	(L19+L28)/L1
30. Assumed Earnings Reductions Retirement of Old Assets	L2*L29
31. Proportion of Assets Financed by Debt	TABLE 7
32. Reduction of Net Income Due to Retirement of Old Assets	L30*(1-L31)
33. Net Earnings on Old Assets	L28-L32
34. Cost Index	YR[1]/YR[0]
35. Expected Earnings on Old Assets	L33*L34
36. Marginal Cost of Equity	TABLE 7
37. Required Return on New Investments Financed by Equity	L27*L36
38. Marginal Weighted Average Cost of Capital-After Tax	TABLE 7
39. Required Total Return on New Investments Financed by Depreciation, Deferred Taxes and Other Income	L9*L38
40. Required Earnings on New Investment	L39+L37
41. Net Income Required	L35+L40
EARNINGS REQUIRED TO PROVIDE ADEQUATE FIXED CHARGE COVERAGE	
42. Target Fixed Charge Coverage (times interest earned)	GIVEN
43. Income Required for Adequate Fixed Charge Coverage (before tax)	L23*L42
44. Tax Rate	TABLE 7
45. Net Income Required	(L43-L23)*(1-L44)+L24

TABLE A-III 1(con't)

	FORMULAS
EARNINGS REQUIRED TO PROVIDE REQUIRED EQUITY CAPITAL FROM RETAINED EARNINGS	
46. Common Dividends(base year)	TABLE 6
47. Dividend Yield on Equity Investment (percent of net income)	L46/L28
48. Required Dividends from Old Assets	L35*L47
49. Required Dividends on New Equity Investment	L47*L40
50. Total Required Dividends	L48+L49+24
51. Net Income Required	L50+L27
REQUIRED RETURN ON NET INVESTMENT TO:	
52. Provide a Return on Existing Investment at the Base Year Level and to Make New Investments Profitable	(L41+L23)/L1
53. Provide Adequate Fixed Charge Coverage	(L45+L23)/L1
54. Provide Required Equity Capital From Retained Earnings	(L51+L23)/L1

TABLE A-III 2
CP RAIL
FUNDS FLOW ANALYSIS
1977 TO 1982

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
ASSET BASE						
1. Net Investment in Road and Equipment Property at End of Base Year	1,584,875,724	1,615,356,514	1,669,182,042	1,769,162,760	1,870,687,519	2,016,652,724
SOURCES OF FUNDS (Excluding Net Income)						
2. Depreciation	75,643,000	77,558,000	79,613,000	86,751,000	95,649,000	103,192,000
3. Deferred Income Taxes	2,057,000	3,426,000	10,569,000	38,172,000	47,450,000	57,666,000
4. Salvage	18,900,000	11,806,000	13,400,000	14,106,000	13,521,000	11,802,000
5. Sale of Property	10,377,000	858,000	16,247,000	2,301,000	22,115,000	1,458,000
6. Total	106,977,000	93,648,000	119,829,000	141,330,000	178,735,000	174,118,000
APPLICATION OF FUNDS (Excluding Capital Additions)						
7. Redemption-Preferred shares	2,391,379	1,993,095	2,829,198	3,081,886	1,847,898	2,418,427
8. Total	2,391,379	1,993,095	2,829,198	3,081,886	1,847,898	2,418,427
9. Net Funds Available for Capital Additions	104,585,621	91,654,905	116,999,802	138,248,114	176,887,102	171,699,573
CAPITAL ADDITIONS						
10. Projected Investment	121,451,000	143,600,000	163,449,000	209,786,000	311,133,000	274,384,000
11. New Capital Required	16,865,379	51,945,095	46,449,198	71,537,886	134,245,898	102,684,427
DEBT AND PREFERRED STOCK FINANCING						
12. Debt Outstanding	438,575,800	439,826,400	436,459,400	414,075,438	406,713,036	494,918,259
13. Marginal Debt Ratio	31.737%	31.177%	29.959%	26.922%	25.357%	29.105%
14. Marginal Preferred Stock Ratio	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
15. New Debt Required	5,352,503	16,194,698	13,915,736	19,259,177	34,040,209	29,886,017
16. Marginal Cost of Debt	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
17. Embedded Cost of Debt	5.385%	5.325%	5.274%	5.250%	5.860%	7.280%
18. Fixed Charges on New Debt	559,337	1,700,443	1,564,129	2,547,989	5,500,898	4,880,386
19. Previous Year's Fixed Charges	23,616,012	23,419,947	23,018,588	21,738,960	23,833,384	36,030,049
20. Interest Savings Due to Recapitalization (CN only)	0	0	0	0	0	0
21. Debt Due in One Year	35,900,000	14,400,000	27,600,000	18,500,000	20,100,000	12,700,000
22. Total Cost-Roll-Over Debt	719,275	360,600	1,215,165	1,048,900	1,816,735	1,087,360
23. Total Fixed Charges	24,894,624	25,480,990	25,797,882	25,335,850	31,151,017	41,997,796
24. Required Preferred and Preference Dividends	2,446,819	2,240,714	2,012,534	1,854,352	1,702,669	1,488,526

TABLE A-III 2(con't)

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
EQUITY FINANCING						
25. Book Value of Equity	943,347,165	970,933,112	1,020,394,093	1,124,000,723	1,197,259,406	1,205,555,861
26. New Equity Ratio	68.263%	68.823%	70.041%	73.078%	74.643%	70.895%
27. New Equity Required	11,512,876	35,750,397	32,533,461	52,278,709	100,205,689	72,798,410
EARNINGS REQUIRED TO PROVIDE A RETURN ON EXISTING INVESTMENT AT THE BASE YEAR LEVEL AND TO MAKE NEW INVESTMENTS PROFITABLE						
28. Previous Years' Net Income	50,466,000	54,334,000	63,256,000	93,025,000	121,376,000	126,420,000
29. Previous Years' Return on Net Investment	4.674%	4.813%	5.169%	6.487%	7.762%	8.055%
30. Assumed Earnings Reductions Retirement of Old Assets	3,535,789	3,733,195	4,114,937	5,627,458	7,424,614	8,312,559
31. Proportion of Assets Financed by Debt	27.673%	27.228%	26.148%	23.405%	21.741%	24.542%
32. Reduction of Net Income Due to Retirement of Old Assets	2,557,345	2,716,727	3,038,959	4,310,342	5,810,401	6,272,527
33. Net Earnings on Old Assets	47,908,655	51,617,273	60,217,041	88,714,658	115,565,599	120,147,473
34. Cost Index	1.080	1.089	1.109	1.147	1.144	1.105
35. Expected Earnings on Old Assets	51,751,170	56,206,695	66,794,565	101,716,375	132,150,513	132,793,602
36. Marginal Cost of Equity	13.500%	14.250%	14.550%	15.000%	15.500%	16.000%
37. Required Return on New Investments Financed by Equity	1,554,238	5,094,432	4,733,619	7,841,806	15,531,882	11,647,746
38. Marginal Weighted Average Cost of Capital-After Tax	9.716%	10.224%	10.587%	10.974%	11.138%	11.325%
39. Required Total Return on New Investments Financed by Depreciation, Deferred Taxes and Other Income	10,161,196	9,371,253	12,386,805	15,171,249	19,702,007	19,444,409
40. Required Earnings on New Investment	11,715,434	14,465,684	17,120,424	23,013,055	35,233,889	31,092,154
41. Net Income Required	63,466,604	70,672,379	83,914,989	124,729,431	167,384,402	163,885,756
EARNINGS REQUIRED TO PROVIDE ADEQUATE FIXED CHARGE COVERAGE						
42. Target Fixed Charge Coverage (times interest earned)	3.50	3.50	3.50	3.50	3.50	3.50
43. Income Required for Adequate Fixed Charge Coverage (before tax)	87,131,182	89,183,465	90,292,586	88,675,474	109,028,558	146,992,285
44. Tax Rate	50.000%	50.000%	49.610%	48.598%	48.074%	47.873%
45. Net Income Required	33,565,098	34,091,952	34,511,415	34,412,185	42,141,362	56,219,004

TABLE A-III 2(con't)

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
EARNINGS REQUIRED TO PROVIDE REQUIRED EQUITY CAPITAL FROM RETAINED EARNINGS						
46. Common Dividends(base year)	20,384,891	22,921,181	27,482,286	37,977,466	60,994,648	64,299,331
47. Dividend Yield on Equity Investment (percent of net income)	40.393%	42.186%	43.446%	40.825%	50.253%	50.862%
48. Required Dividends from Old Assets	20,904,014	23,711,190	29,019,655	41,525,721	66,409,126	67,541,051
49. Required Dividends on New Equity Investment	4,732,252	6,102,451	7,438,162	9,395,082	17,705,961	15,813,991
50. Total Required Dividends	28,083,085	32,054,356	38,470,351	52,775,155	85,817,756	84,843,568
51. Net Income Required	39,595,961	67,804,753	71,003,812	105,053,864	186,023,445	157,641,978
REQUIRED RETURN ON NET INVESTMENT TO:						
52. Provide a Return on Existing Investment at the Base Year Level and to Make New Investments Profitable	5.575%	5.952%	6.573%	8.482%	10.613%	10.209%
53. Provide Adequate Fixed Charge Coverage	3.689%	3.688%	3.613%	3.377%	3.918%	4.870%
54. Provide Required Equity Capital From Retained Earnings	4.069%	5.775%	5.799%	7.370%	11.609%	9.900%

Notes: Table A-III 2

Purpose: To compute the required rates of return on net book investment to meet each of the three revenue adequacy criteria.

Data Sources: Except for the following input the data is compiled on one of the following supporting tables. Debt Coverage Ratio - This is taken from the ICC study on funds flow for 1978[73].

Comments:

1. The timing assumptions were discussed in Chapter VI. To illustrate, the required return estimated for 1977 is made on December 31 of 1976. All elements of the computation are projections for the forecast year.

2. The estimates for the sources and uses of funds identified in the first part of modem (lines 2-7) are based on the assumption that investors expect these sources and uses to remain at the same level as they were in the base year. In a more comprehensive analysis projects could be made for each of these. However, the task is difficult, especially for deferred taxes and other sources of cash income. A test to determine the sensitivity of the model to these values showed very little impact.

TABLE A-III 3
CP RAIL
TOTAL CAPITALIZATION
(1976 to 1982)

	1976	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$	$
LONG TERM DEBT	438,575,800	439,826,400	436,459,400	414,075,438	406,713,036	494,918,259	534,659,000
ACCUMULATED DEFERRED TAXES	101,691,113	105,318,269	115,929,532	140,062,128	178,297,373	225,747,089	284,577,000
PREFERRED & PREFERENCE STOCK	101,261,646	99,278,733	96,399,017	91,024,471	88,417,704	90,431,515	86,116,000
SHAREHOLDERS EQUITY	943,347,165	970,933,112	1,020,394,093	1,124,000,723	1,197,259,406	1,205,555,861	1,266,819,000
TOTAL	1,584,875,724	1,615,356,514	1,669,182,042	1,769,162,760	1,870,687,519	2,016,652,724	2,172,171,000

Notes: Table A-III 3

Purpose: To construct a balance sheet and capital structure for the rail division.

Data: The data for this table had to be collected from a number of sources:

1. The CTC annual cost of capital determinations for 1979 to 1982[119][120][121][122].
2. Statistics Canada[6].
3. CP Rails reports to the Securities and Exchange Commission[26].
4. CP Rail Cash Flow Statement[38].
5. CP Rail Annual Reports to shareholders[25].
6. CP Rail Evidence for the Cost of Capital Hearing[40].

Comments:

1. The CTC published its cost of capital determinations starting in 1979. From these reports it was possible to determine their methodology for computing the capital structure. This methodology was accepted with some concerns already expressed in the text of this paper and was used to construct the table for 1976-1978.

2. The table only contains the right-hand side of the balance

sheet. The asset side is not shown because it could not be constructed with available information. Since the net book value is important in determining the amount of equity assigned to the railway the procedure used by the CTC is outlined below:

a. Gross investment in the rail system is identified. This includes subsidiary companies and jointly owned companies in the railway business.

b. From gross investment the following are deducted:

    i. Accumulated depreciation. This is adjusted for a change in depreciation methods which occurred in the 1950's.

    ii. Donations and grants are deducted except for those allowed by the CTC. The donation not deducted include a portion of the original land grants to CP Rail.

c. An allowance for working capital is then added. This has been at $70 million since the mid 1950's.

d. Insurance and other funds identifiable with the railway are also added.

3. In computing the liabilities for years prior to 1979 the methodology used was:

    a. Construct an estimate of the net book value.

    b. Long term debt assigned to the rail division was included in CP Rail's evidence to the Cost of Capital Inquiry.

c. Accumulated deferred taxes were projected back from the 1979 value.

d. Preferred and preference stock balances were computed using Statistics Canada data[140]. Statistics Canada reports only the book value of these securities and does not include the premium on conversion which the CTC does. The amount of the premium was found in the CP Rail evidence to the cost of capital inquiry[40,Part III,tab 14] and added to the reported values. The total was then pro-rated between CP Rail and CP Telecommunications. For regulatory purposes CP Rail allocates these securities to only these two divisions.

e. The shareholders equity was then computed as the value which balances the liabilities to the net book value.

TABLE A-III 4
CP RAIL
SOURCE AND USES OF FUNDS STATEMENT
1976 TO 1982

	1976	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$	$
SOURCES OF FUNDS							
NET INCOME	50,466,000	54,334,000	63,256,000	93,025,000	121,376,000	126,420,000	117,873,000
DEPRECIATION	75,643,000	77,558,000	79,613,000	82,061,000	86,751,000	95,649,000	103,192,000
DEFERRED INCOME TAXES	2,057,000	3,426,000	10,569,000	24,728,000	38,172,000	47,450,000	57,666,000
SALVAGE	18,900,000	11,806,000	13,400,000	21,345,000	14,106,000	13,521,000	11,802,000
PROCEEDS FROM SALE OF PROPERTY	10,377,000	858,000	16,247,000	2,301,000	22,115,000	1,458,000	7,363,000
TOTAL SOURCES OF FUNDS	157,443,000	147,982,000	183,085,000	223,460,000	282,520,000	284,498,000	297,896,000
USES OF FUNDS							
REDEMPTION OF PREFERRED STOCK & DIVIDENDS(common,preferred and preference)	22,976,000	25,368,000	29,723,000	39,990,000	62,849,000	66,002,000	60,822,000
TOTAL NON-CAPITAL USES	22,976,000	25,368,000	29,723,000	39,990,000	62,849,000	66,002,000	60,822,000
CAPITAL ADDITIONS	110,292,000	121,451,000	143,600,000	163,449,000	209,786,000	311,133,000	274,384,000
TOTAL USES OF FUNDS	133,268,000	146,819,000	173,323,000	203,439,000	272,635,000	377,135,000	335,206,000
ADJUSTMENTS IN LONG TERM DEBT							
CHANGES IN LONG TERM DEBT ASSIGNED TO RAIL DIVISION(+ indicates an increase in debt assigned and a () indicates a decrease	(24,175,000)	(1,163,000)	(9,762,000)	(20,021,000)	(9,885,000)	92,637,000	37,310,000

Notes - Table A-III 4

Purpose: To present a source and uses of funds statement.

Data: This table is a summary of the Cash flow Statement[38] provided during the Cost of Capital Inquiry.

Comment:

1. These figures are not the same as those reported to Statistics Canada because they exclude everything but Canadian rail operations.

2. The bottom line of the table is included for illustration only. It shows how CP Rail's debt allocation formula works. Where there are positive cash flows the amount of debt assigned to the rail division declines.

TABLE A-III 5
CP RAIL
REDEMPTION OF PREFERRED STOCK
1976 to1982

	1976	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$	$
TOTAL COST OF REDEMPTION	2,512,400	2,093,750	2,973,590	3,243,000	1,967,000	2,597,000	1,978,000
NET INVESTMENT:							
RAIL	1,584,875,724	1,615,356,514	1,669,182,042	1,769,162,760	1,870,687,519	2,016,652,724	2,172,171,000
TELECOMMUNICATIONS	80,206,334	81,578,253	85,189,249	92,487,615	120,571,178	148,907,000	162,607,000
TOTAL	1,665,082,058	1,696,934,767	1,754,371,291	1,861,650,375	1,991,258,697	2,165,559,724	2,334,778,000
REDEMPTION COSTS ATTRIBUTABLE TO:							
RAIL	2,391,379	1,993,095	2,829,198	3,081,886	1,847,898	2,418,427	1,840,241
TELECOMMUNICATIONS	121,021	100,655	144,392	161,114	119,102	178,573	137,759

Notes: Table A-III 5

Purpose: To identify the costs of redeeming preferred shares assignable to the rail division.

Data: The source of information is the report to stockholders[25].

Comment:

1. The report to stockholders identifies the annual cost of redeeming preferred shares. Since CP Ltd. allocates these between the rail and telecommunications divisions, the cost of redeeming these shares must be allocated. The basis for allocating the cost is the net investment identified in Table A-III-3.

TABLE A-III 6
CP RAIL
DIVIDENDS
1976 to 1982

	1976	1977	1978	1979
	$	$	$	$
TOTAL-DIVIDENDS & REDEMPTION OF PREFERRED STOCK	22,976,000	25,368,000	29,723,000	39,990,000
less:COST OF REDEMPTION OF PREFERRED STOCK	2,391,379	1,993,095	2,829,198	3,081,886
TOTAL DIVIDENDS	22,976,000	25,368,000	29,723,000	39,990,000

	YIELD(*)	$	YIELD(*)	$	YIELD(*)	$	YIELD	$
PREFERENCE SHARES-STERLING								
AMOUNT OUTSTANDING	1.860%	3,545,977	1.860%	3,545,977	1.860%	3,545,977	0.210%	39,971,748
DIVIDENDS		65,955		65,955		65,955		83,941
PREFERENCE SHARES-$Cdn								
AMOUNT OUTSTANDING	4.000%	10,992,743	4.000%	10,992,743	4.000%	10,992,743	1.410%	30,634,655
DIVIDENDS		439,710		439,710		439,710		431,949
PREFERRED STOCK								
AMOUNT OUTSTANDING	7.250%	28,764,743	7.250%	26,774,540	7.250%	23,931,718	7.330%	20,418,068
DIVIDENDS		2,085,444		1,941,154		1,735,050		1,496,644
TOTAL PREFERRED AND PREFERENCE DIVIDENDS		2,591,109		2,446,819		2,240,714		2,012,534
COMMON DIVIDENDS		20,384,891		22,921,181		27,482,286		37,977,466

* These yields are on the face value of the security as opposed to the yield on the value of the security including premiums.

TABLE A-III 6
CP RAIL
DIVIDENDS
1976 to 1982
(CONTINUED)

	1980		1981		1982	
		$		$		$
TOTAL-DIVIDENDS & REDEMPTION OF PREFERRED STOCK		62,849,000		66,002,000		60,822,000
less:COST OF REDEMPTION OF PREFERRED STOCK		1,847,898		2,418,427		1,840,241
TOTAL DIVIDENDS		62,849,000		66,002,000		60,822,000
	YIELD	$	YIELD	$	YIELD(*)	$
PREFERENCE SHARES-STERLING						
AMOUNT OUTSTANDING	0.230%	39,631,200	0.180%	41,673,679	1.860%	3,545,977
DIVIDENDS		91,152		75,013		65,955
PREFERENCE SHARES-$Cdn						
AMOUNT OUTSTANDING	1.410%	30,373,657	1.410%	31,939,028	4.000%	10,992,743
DIVIDENDS		428,269		450,340		439,710
PREFERRED STOCK						
AMOUNT OUTSTANDING	7.250%	18,412,847	7.000%	16,818,808	7.250%	13,556,708
DIVIDENDS		1,334,931		1,177,317		982,861
TOTAL PREFERRED AND PREFERENCE DIVIDENDS		1,854,352		1,702,669	1.730%	1,488,526
COMMON DIVIDENDS		60,994,648		64,299,331		59,333,474

* These yields are on the face value of the security as opposed to the yield on the value of the security including premiums.

Notes: Table A-III 6

Purpose: To separate the preferred, preference and common dividends.

Data:

1. The total cost of preferred dividends, preference dividends, common dividends, as well as the cost of redeeming preferred shares was given in Table A-III-4.
2. CTC Cost of Capital Determinations 1979-1982[119][120][121][122].
3. Statistics Canaada 1976-1982[144].
4. Annual Report to Shareholders[25].

Comments:

1. The first step was to separate out the cost of redemption by deducting the amount computed on Table A-III-5.

2. To compute the dividends the procedure was to first compute the preferred and preference dividends and deduct this from total dividends to obtain the common dividends.

3. For the period 1979 to 1981 the CTC reports on the cost of capital determination contained both the amount outstanding (including all premiums) and the yield, after foreign currency translation.

4. In 1982 the railways altered their procedure by using the book value of the preferred and preference shares. The coupon rate was then applied to this amount.

5. Since the face values of the preferred and preference shares were available for the 1976 to 1978 period, the book yields reported for 1982 were applied to these amounts to compute the dividend costs.

TABLE A-III 7
CP RAIL
COST OF CAPITAL
(1976 to 1982)

	1976	1977	1978	1979	1980	1981	1982
DEBT FINANCING							
MARGINAL FINANCING RATIO	0.317	0.312	0.300	0.269	0.254	0.291	0.297
MARGINAL COST OF DEBT	10.950%	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
EMBEDDED FINANCING RATIO	0.277	0.272	0.261	0.234	0.217	0.245	0.246
EMBEDDED COST OF DEBT	5.385%	5.325%	5.274%	5.250%	5.860%	7.280%	7.820%
PREFERRED AND PREFERENCE STOCK FINANCING							
MARGINAL FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MARGINAL COST-PREFERRED	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EMBEDDED FINANCING RATIO	0.064	0.061	0.058	0.051	0.047	0.045	0.040
EMBEDDED COST(average)	2.559%	2.465%	2.324%	2.220%	2.110%	1.910%	1.730%
EQUITY FINANCING							
MARGINAL FINANCING RATIO	0.683	0.688	0.700	0.731	0.746	0.709	0.703
MARGINAL COST OF EQUITY	13.500%	13.500%	14.250%	14.550%	15.000%	15.500%	16.000%
EMBEDDED FINANCING RATIO	0.595	0.601	0.611	0.635	0.640	0.598	0.583
DEFERRED TAXES							
MARGINAL FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MARGINAL COST	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EMBEDDED FINANCING RATIO	0.064	0.065	0.069	0.079	0.095	0.112	0.131
EMBEDDED COST	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAX RATE	50.000%	50.000%	50.000%	49.610%	48.598%	48.074%	47.873%
WEIGHTED AVERAGE COST OF CAPITAL							
MARGINAL-BEFORE TAX	21.906%	21.840%	23.107%	24.127%	25.137%	25.866%	26.431%
MARGINAL-AFTER TAX	12.691%	12.549%	13.127%	13.659%	14.551%	15.692%	16.098%
EMBEDDED-BEFORE TAX	17.888%	17.982%	19.070%	19.800%	20.145%	19.796%	19.957%
EMBEDDED-AFTER TAX	9.689%	9.716%	10.224%	10.587%	10.974%	11.138%	11.325%

Notes: Table A-III 7

Purpose: To compile data on the marginal financing ratios and the costs of the various elements of capital.

Data: With the exceptions of the capital structure which was taken from Table A-III-3 and the embedded cost of debt which is obtained from Table A-III-8, all data was obtained from the annual CTC cost of capital determinations[119][120][121][122].

Comment:

1. Marginal financing is allocated to debt and equity only. The use of preferred or preference financing is excluded to reflect management's decision not to use this form of security to raise additional capital. The manner in which the model treats deferred taxes as a source of funds precludes it being identified in this calculation as a marginal source of financing.

2. The marginal cost of debt is the effective yield on a CP Ltd. collateral trust bond. This figure is included in each year's submission to the CTC for the cost of capital determination.

3. For the period 1979 to 1982 the embedded cost of debt was published as part of the cost of capital determination.

However, this was not the case for the years 1976 to 1978. The embedded cost of debt had to be calculated for these years. (See Table A-III-8.)

4. The average cost of preferred and preference stock also had to be calculated for the 1976 to 1978 period. This was done by dividing the dividends calculated in Table A-III-6 by the book value.

5. For reasons given in the body of the report, the CTC approved cost of capital rate was used. The only rate available on an after tax base for the entire study period was the rate set for subsidy purposes.

6. When the cost of capital is computed using embedded weights, deferred taxes are assigned a zero cost. The reasons for this were given in the text of this paper.

7. In the time span for which data was available (1979 to 1982) the tax rate used by the CTC was used in this analysis. In the other years where no information was available a 50 per cent rate was assumed.

TABLE A-III 8
CP RAIL
COMPUTATION OF THE COSTS OF ROLLING OVER DEBT
1977 TO 1982

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
TOTAL DEBT RETIRED	35,900,000	14,400,000	27,600,000	18,500,000	20,100,000	12,700,000
INTEREST SAVINGS FROM DEBT RETIREMENT	3,032,275	1,151,400	1,887,075	1,398,650	1,431,425	986,550
MARGINAL COST OF DEBT	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
INTEREST COSTS FOR ROLLED OVER DEBT	3,751,550	1,512,000	3,102,240	2,447,550	3,248,160	2,073,910
ADDITIONAL FIXED CHARGES-ROLLED-OVER DEBT	719,275	360,600	1,215,165	1,048,900	1,816,735	1,087,360
WEIGHTED AVERAGE COST OF DEBT (EMBEDDED)	5.325%	5.274%	5.277%	5.345%	6.945%	7.251%

* 1976 Cost of Debt 5.385%

Notes: Table A-III 8

Purpose: To compute the additional fixed charges attributed to debt rolled-over and the embedded cost of debt for 1976 to 1978.

Data:

1. CP Rail's submission to the Cost of Capital Review[40] contained a detailed debt allocation table.
2. The CTC's annual cost of capital determination[119][120][121][122] contained data on the costs of leased line securities and capital leases.

Comment:

1. The debt is allocated to CP Rail using the allocation formula described in Chapter IV. From year to year the amount of debt allocated to the railway changes. This procedure is accepted with some reluctance because it mixes genuine debt retirement with decreases in the debt assigned to the railway in those years when there is a cash flow in excess of needs (see Table A-III-4). It is not necessary to separate these. The model uses the base years capital structure as the basis for financing the capital additions in the forecast period. Therefore, any debt which disappears from the base year capital structure has

to be assumed to be rolled over. If this was not done, the capital structure would not remain the same as it was in the base year.

2. Each of the railways debt instruments, equipment trust certificates, collateral trust bonds, consolidated debenture stock, leased line securities, and capitalized leases (after 1978) were analyzed. Reductions in the amounts outstanding and the annual interest charges of each were noted. The net increase in interest charges associated with the roll-over is the difference between the marginal cost of new debt and the embedded cost of the retired debt. Ideally a different cost of debt should have been assigned to each security type but the magnitude of the cost relative to other costs in the model was too small to justify doing this.

3. This table was also used to compute the embedded cost of debt for 1976 to 1978. For these years it was not possible to exactly duplicate the procedure used by the CTC to obtain the embedded rates. The numbers computed on this table are a fraction below those used by the CTC and included in Table A-III-7. One reason for this is that information on premiums and/or discounts and issuance costs were not available for the 1977 to 1979 period.

TABLE A-III 9
CP RAIL
ESTIMATED COST INDEX
1976 TO 1982

COST COMPONENT	WEIGHT	1976	1977	1978	1979	1980	1981	1982
LABOUR	0.3900	100.00	109.47	118.61	129.60	143.21	156.33	182.25
MATERIALS	0.2700	100.00	107.57	117.98	134.56	153.69	175.67	192.92
FUEL	0.1200	100.00	116.26	131.75	158.53	207.96	284.12	322.99
DEPRECIATION	0.0400	100.00	100.00	100.00	100.00	100.00	100.00	100.00
COST OF CAPITAL	0.1800	100.00	101.86	109.46	114.29	129.38	136.50	128.59
WEIGHTED INDEX		100.00	108.02	117.62	130.47	149.59	171.06	189.07

Notes: Table A-III 9

Purpose: To compute a weighted cost index to be used to adjust the base year net income.

Data:

1. The weights of the five cost categories were obtained from the Gilson Report[56].
2. Labour index is taken from Statistics Canada[141] labour cost report which gives indices for monthly railway wages (SIC 503).
3. The industrial selling price index was used for materials[142].
4. The fuel index was taken from the diesel fuel category in the industrial selling price index[142].
5. The CTC approved cost of capital rates were used to construct a capital cost index.

Comments:

1. This is strictly a cost index and is not adjusted for productivity.

2. Depreciation was not indexed in this calculation. There is a good argument for indexing it to reflect the cost of replacing existing assets (not adding new ones) but computation is extremely complex.

APPENDIX IV

CN RAIL: FUNDS FLOW ANALYSIS

INTRODUCTION

This appendix contains the detailed funds flow computation for CN Rail. To avoid repetition only differences between this computation and the CP Rail computation are noted. The algorithm is also omitted as it is the same for both railways. To facilitate comparison the numbering scheme for the supporting tables is the same as that used in Appendix III. Some tables, namely 5 and 6, are not needed for this computation and, therefore, are not included here..

There is one data problem which persisted all the way through the CN Rail analysis. In some sources, Statistics Canada[140] in particular, the figures reported for the railway include more than just the Canadian rail operations. They sometimes include the Grand Trunk Western, an American subsidiary as well as express operations. One source which did help in resolving this problem was the annual report CN makes to the U.S. Securities and Exchange Commission[24]. Those areas where the data could not be split are noted.

TABLE A-IV 2
CN RAIL
FUNDS FLOW ANALYSIS
1977 TO 1982

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
ASSET BASE						
1. Net Investment in Road and Equipment Property at End of Base Year	2,687,139,783	2,834,876,890	2,863,212,000	3,037,325,000	3,296,219,000	3,693,071,000
SOURCES OF FUNDS(Excluding Net Income)						
2. Depreciation	117,913,000	124,479,870	122,316,000	137,802,000	154,337,000	165,281,000
3. Deferred Income Taxes	0	0	0	0	0	0
4. Salvage	0	16,630,000	74,086,000	16,238,000	13,889,000	5,713,000
5. Sale of Property	0	0	0	0	0	0
6. Total	117,913,000	141,109,870	196,402,000	154,040,000	168,226,000	170,994,000
APPLICATION OF FUNDS(Excluding Capital Additions)						
7. Redemption-Preferred shares	0	0	0	0	0	0
8. Total	0	0	0	0	0	0
9. Net Funds Available for Capital Additions	117,913,000	141,109,870	196,402,000	154,040,000	168,226,000	170,994,000
CAPITAL ADDITIONS						
10. Projected Investment	277,995,250	277,857,000	323,864,000	412,934,000	565,078,000	470,333,000
11. New Capital Required	160,082,250	136,747,130	127,462,000	258,894,000	396,852,000	299,339,000
DEBT AND PREFERRED STOCK FINANCING						
12. Debt Outstanding	1,504,798,278	1,048,904,449	1,065,114,864	1,154,183,500	1,308,598,943	1,595,406,672
13. Marginal Debt Ratio	56.000%	37.000%	37.200%	38.000%	39.700%	43.200%
14. Marginal Preferred Stock Ratio	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
15. New Debt Required	89,646,060	50,596,438	47,415,864	98,379,720	157,550,244	129,314,448
16. Marginal Cost of Debt	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
17. Embedded Cost of Debt	6.540%	7.090%	7.210%	7.770%	8.050%	9.420%
18. Fixed Charges on New Debt	9,368,013	5,312,626	5,329,543	13,015,637	25,460,119	21,117,049
19. Previous Year's Fixed Charges	98,407,348	74,363,002	76,794,782	89,680,058	105,342,215	150,287,309
20. Interest Savings Due to Recapitalization	0	0	108,135	0	0	0
21. Debt Due in One Year	188,739,200	14,385,400	34,891,500	153,190,200	254,346,800	15,003,600
22. Total Cost-Roll-Over Debt	8,636,498	406,835	(328,425)	12,589,086	22,495,112	447,760
23. Total Fixed Charges	116,411,859	80,082,462	81,795,899	115,284,781	153,297,446	171,852,118
24. Required Preferred and Preference Dividends	0	0	0	0	0	0

TABLE A-IV 2(con't)

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
EQUITY FINANCING						
25. Book Value of Equity	1,182,341,505	1,785,972,441	1,798,097,136	1,883,141,500	1,987,620,057	2,097,664,328
26. New Equity Ratio	44.000%	63.000%	62.800%	62.000%	60.300%	56.800%
27. New Equity Required	70,436,190	86,150,692	80,046,136	160,514,280	239,301,756	170,024,552
EARNINGS REQUIRED TO PROVIDE A RETURN ON EXISTING INVESTMENT AT THE BASE YEAR LEVEL AND TO MAKE NEW INVESTMENTS PROFITABLE						
28. Previous Years' Net Income	(29,809,955)	60,539,326	80,155,000	105,448,000	131,853,000	136,038,000
29. Previous Years' Return on Net Investment	2.553%	4.759%	5.482%	6.424%	7.196%	7.753%
30. Assumed Earnings Reductions Retirement of Old Assets	3,010,087	5,923,581	6,704,872	8,852,868	11,106,058	12,814,304
31. Proportion of Assets Financed by Debt	56.000%	37.000%	37.200%	38.000%	39.700%	43.200%
32. Reduction of Net Income Due to Retirement of Old Assets	1,324,438	3,731,856	4,210,660	5,488,778	6,696,953	7,278,524
33. Net Earnings on Old Assets	(31,134,393)	56,807,470	75,944,340	99,959,222	125,156,047	128,759,476
34. Cost Index	1.081	1.080	1.116	1.156	1.161	1.083
35. Expected Earnings on Old Assets	(33,650,419)	61,354,549	84,728,633	115,574,154	145,263,420	139,424,135
36. Marginal Cost of Equity	13.500%	14.250%	14.550%	15.000%	15.500%	16.000%
37. Required Return on New Investments Financed by Equity	9,508,886	12,276,474	11,646,713	24,077,142	37,091,772	27,203,928
38. Marginal Weighted Average Cost of Capital-After Tax	11.128%	11.631%	11.974%	12.241%	12.873%	13.826%
39. Required Total Return on New Investments Financed by Depreciation, Deferred Taxes and Other Income	13,121,533	16,412,658	23,516,390	18,855,805	21,656,473	23,641,220
40. Required Earnings on New Investment	22,630,418	28,689,132	35,163,103	42,932,947	58,748,245	50,845,148
41. Net Income Required	(11,020,001)	90,043,681	119,891,736	158,507,101	204,011,665	190,269,283
EARNINGS REQUIRED TO PROVIDE ADEQUATE FIXED CHARGE COVERAGE						
42. Target Fixed Charge Coverage (times interest earned)	3.50	3.50	3.50	3.50	3.50	3.50
43. Income Required for Adequate Fixed Charge Coverage (before tax)	407,441,506	280,288,619	286,285,648	403,496,733	536,541,060	601,482,412
44. Tax Rate	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
45. Net Income Required	291,029,647	200,206,156	204,489,748	288,211,952	383,243,615	429,630,294

TABLE A-IV 2(con't)

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
EARNINGS REQUIRED TO PROVIDE REQUIRED EQUITY CAPITAL FROM RETAINED EARNINGS						
46. Common Dividends(base year)	0	0	16,031,000	21,090,000	26,371,000	27,208,000
47. Dividend Yield on Equity Investment (percent of net income)	0.000%	0.000%	20.000%	20.000%	20.000%	20.000%
48. Required Dividends from Old Assets	0	0	16,945,727	23,115,269	29,053,125	27,885,237
49. Required Dividends on New Equity Investment	0	0	7,032,621	8,586,752	11,749,827	10,169,179
50. Total Required Dividends	0	0	23,978,347	31,702,021	40,802,952	38,054,416
51. Net Income Required	70,436,190	86,150,692	104,024,483	192,216,301	280,104,708	208,078,968
REQUIRED RETURN ON NET INVESTMENT TO:						
52. Provide a Return on Existing Investment at the Base Year Level and to Make New Investments Profitable	3.922%	6.001%	7.044%	9.014%	10.840%	9.805%
53. Provide Adequate Fixed Charge Coverage	15.163%	9.887%	9.999%	13.285%	16.277%	16.287%
54. Provide Required Equity Capital From Retained Earnings	6.953%	5.864%	6.490%	10.124%	13.148%	10.288%

Notes: Table A-IV 2

Comments:

1. The only difference to note in this calculation is the interest cost savings in 1978. This is caused by the writing off of $808 million of debt owing to the Federal Government[155]. To avoid over estimating the previous years fixed charges the interest savings computed on Table A-IV-8 had to be deducted.

2. The 1977 computation is based on a loss which CN Rail incurred in 1976. For reasons given in the text of the report the model was rerun with the base year net income set to zero. This has the affect of raising the required return for criterion I to 5.098%. This puts it more in line with the other years.

TABLE A-IV 3
CN RAIL
TOTAL CAPITALIZATION
(1976 to 1982)

	1976	1977	1978	1979	1980	1981	1982
LIABILITIES	$	$	$	$	$	$	$
LONG TERM DEBT	1,504,798,278	1,048,904,449	1,065,114,864	1,154,183,500	1,308,598,943	1,595,406,672	2,028,144,280
ACCUMULATED DEFERRED TAXES	0	0	0	0	0	0	0
PREFERRED STOCK	0	0	0	0	0	0	0
SHAREHOLDERS EQUITY	1,182,341,505	1,785,972,441	1,798,097,136	1,883,141,500	1,987,620,057	2,097,664,328	1,964,265,720
TOTAL	2,687,139,783	2,834,876,890	2,863,212,000	3,037,325,000	3,296,219,000	3,693,071,000	3,992,410,000

Notes: Table A-IV 3

Data:

1. CTC annual cost of capital determination for CN Rail for 1981 to 1982[117][118].

2. CN Rail's reports to the U.S. Securities and Exchange Commission[24].

Comments:

1. CN Rail's capital structure is made up of debt and equity only. For the years 1978 to 1982 the debt to equity ratio was given. To estimate 1976 and 1977 the debt ratio for the entire corporation was computed and applied to the rail division. The 1978 debt ratio could not be used because it reflected the changes caused by recapitalization.

TABLE A-IV 4
CN RAIL
SOURCE AND USES OF FUNDS STATEMENT
1976 TO 1982

	1976	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$	$
SOURCES OF FUNDS							
NET INCOME	(29,809,955)	60,539,326	80,155,000	105,448,000	131,853,000	136,038,000	(130,953,000)
DEPRECIATION	117,913,000	124,479,870	122,316,000	130,625,000	137,802,000	154,337,000	165,281,000
DEFERRED INCOME TAXES	0	0	0	0	0	0	0
SALVAGE	0	16,630,000	74,086,000	19,126,000	16,238,000	13,889,000	5,713,000
PROCEEDS FROM SALE OF PROPERTY	0	0	0	0	0	0	0
TOTAL SOURCES OF FUNDS	88,103,045	201,649,196	276,557,000	255,199,000	285,893,000	304,264,000	40,041,000
USES OF FUNDS							
REDEMPTION OF PREFERRED STOCK & DIVIDENDS(common,preferred and preference)	0	0	16,031,000	21,090,000	26,371,000	27,208,000	0
TOTAL NON-CAPITAL USES	0	0	16,031,000	21,090,000	26,371,000	27,208,000	0
CAPITAL ADDITIONS	301,670,907	277,995,250	277,857,000	323,864,000	412,934,000	565,078,000	470,333,000
TOTAL USES OF FUNDS	301,670,907	277,995,250	293,888,000	344,954,000	439,305,000	592,286,000	470,333,000
ADJUSTMENTS IN LONG TERM DEBT							
CHANGES IN LONG TERM DEBT ASSIGNED TO RAIL DIVISION(+ indicates an increase in debt assigned and a () indicates a decrease	213,567,861	76,346,054	17,331,000	89,755,000	153,412,000	288,022,000	430,292,000

Notes: Table A-IV 4

Data:

1. The CTC's 1982 report on CN Rail's cost of capital for 1982[118] contained a source and application of funds statement for the years 1978 to 1982.

2. The sources and use of funds for 1976 and 1977 had to be obtained from Statistics Canada[140] and CN Rail's 10K report to the U.S. Securities and Exchange Commission[24].

Comments:

1. Depreciation for 1976 and 1977 had to be taken from Statistics Canada. The same problem arose here as occurred with the gross investment reported in Table A-IV-3. Since the depreciation is on a larger asset base, the depreciation drops from 1977 to 1978 when the proper asset base has been used.

2. Net Income for 1976 and 1977 could only be found on a before tax basis. Therefore the annual fixed charges had to be computed using the embedded cost of debt found on Table A-IV-8 and the amount of debt assigned to the railway from Table A-IV-3.

3. Capital expenditures by the rail division for 1976 and 1977 were constructed from information contained in the report to the U.S.

Securities and Exchange Commission. To obtain the capital expenditures a portion of miscellaneous capital expenditures (80%) was added to the identified capital expenditures on the Canadian rail division.

4. After recapitalization in 1978 CN was expected to pay 20% of net income as a dividend to the Federal Government.

TABLE A-IV 7
CN RAIL
COST OF CAPITAL
(1976 to 1982)

	1976	1977	1978	1979	1980	1981	1982
DEBT FINANCING							
MARGINAL FINANCING RATIO	0.560	0.370	0.372	0.380	0.397	0.432	0.508
MARGINAL COST OF DEBT	10.950%	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
EMBEDDED FINANCING RATIO	0.560	0.370	0.372	0.380	0.397	0.432	0.508
EMBEDDED COST OF DEBT	6.540%	7.090%	7.210%	7.770%	8.050%	9.420%	11.720%
PREFERRED AND PREFERENCE STOCK FINANCING							
MARGINAL FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MARGINAL COST:PREFERRED	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EMBEDDED FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EMBEDDED COST(average)	NA	NA	NA	NA	NA	NA	NA
EQUITY FINANCING							
MARGINAL FINANCING RATIO	0.440	0.630	0.628	0.620	0.603	0.568	0.492
MARGINAL COST OF EQUITY	13.500%	13.500%	14.250%	14.550%	15.000%	15.500%	16.000%
EMBEDDED FINANCING RATIO	0.440	0.630	0.628	0.620	0.603	0.568	0.492
DEFERRED TAXES							
MARGINAL FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
MARGINAL COST	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EMBEDDED FINANCING RATIO	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EMBEDDED COST	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TAX RATE	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
WEIGHTED AVERAGE COST OF CAPITAL							
MARGINAL-BEFORE TAX	12.072%	12.372%	12.855%	13.292%	14.297%	15.785%	16.168%
MARGINAL-AFTER TAX	12.072%	12.372%	12.855%	13.292%	14.297%	15.785%	16.168%
EMBEDDED-BEFORE TAX	9.602%	11.128%	11.631%	11.974%	12.241%	12.873%	13.826%
EMBEDDED-AFTER TAX	9.602%	11.128%	11.631%	11.974%	12.241%	12.873%	13.826%

Notes: Table A-IV 7

Comments:

1. The marginal cost of debt to CN Rail was assumed to be the same as the rate to CP Rail.

2. The embedded cost of debt was computed on Table A-IV-8 for 1976 and 1977. For the period 1978 to 1982 the figures were available.

3. Because the CTC did not make a separate cost of equity determination for CN Rail and assigned the rate found for CP Rail, the same was done here.

4. CN does not pay taxes because huge loss carry forwards. Therefore, a zero cost was used.

TABLE A-IV B
CN RAIL
COMPUTATION OF THE COSTS OF ROLLING OVER DEBT
1977 to 1982

	1977	1978	1979	1980	1981	1982
	$	$	$	$	$	$
TOTAL DEBT RETIRED	188,739,200	14,385,400	34,891,500	153,190,200	254,346,800	15,003,600
INTEREST SAVINGS FROM DEBT RETIREMENT	11,086,749	1,103,632	4,250,230	7,677,978	18,607,331	2,002,328
MARGINAL COST OF DEBT	10.450%	10.500%	11.240%	13.230%	16.160%	16.330%
INTEREST COSTS FOR ROLLED OVER DEBT	19,723,246	1,510,467	3,921,805	20,267,063	41,102,443	2,450,088
ADDITIONAL FIXED CHARGES-ROLLED-OVER DEBT	8,636,498	406,835	(328,425)	12,589,086	22,495,112	447,760
INTEREST SAVINGS FROM RECAPITALIZATION		108,135.4				
WEIGHTED AVERAGE COST OF DEBT(EMBEDDED)	7.090%	8.557%	8.858%	9.535%	11.543%	12.265%

* 1976 Cost of Debt 6.540%

Notes: Table A-IV 8

Comments:

1. CN was the same debt allocation procedure as CP Rail resulting in many of the same concerns. In addition, there is another problem with the CN Rail analysis. While data existed which showed for CP Rail which debt instruments were assigned to the railway, no such allocation was available for CN Rail. Therefore, the computations had to be conducted for the corporate entity.

2. The reduction in the cost of debt after the "roll-over" in 1979 was caused by the retirement of some expensive capital leases and replacing them with lower cost corporate debt.

3. In 1978 CN was recapitalized. The affects on the cost of debt are computed and noted on the table.

4. The weighted cost of debt computed is for all CN debt, not just the portion allocated to CN Rail. It tends to be slightly higher than the rate used by the CTC. This could also be partly attributable to the fact that the embedded cost computed on this table do not adjust for foreign exchange on premiums and discounts associated with the issuance of each debt instrument.